RECORD OF DECISION (ROD)
IR SITES 1 AND 2
(OLD BASE LANDFILL AND FIRE TRAINING AREA)
FOR THE NAVAL TRAINING CENTER-BAINBRIDGE
PORT DEPOSIT, MARYLAND

Contract No. N62472-92-D-1296
Contract Task Order No. 0059

Prepared for:

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February 10, 2000
EA Project 296.0059.2392

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Robert S. Pace for _____ 10 Feb 2000
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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of Concern
DERA	Desktop Ecological Risk Assessment
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FTA	Fire Training Area
HI	Hazard Indices
IR	Installation Restoration
IRM	Interim Remedial Measures
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTC	Former Naval Training Center
OBL	Old Base Landfill
PAH	Polycyclic Aromatic Hydrocarbons
PRAP	Proposed Remedial Action Plan
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act of 1986
SPDES	State Pollutant Discharge Elimination System
TCE	Trichloroethene
TSD	Treatment, Storage, and Disposal
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1. THE DECLARATION

1.1 SITE NAMES AND LOCATIONS

Installation Restoration (IR) Site 1, the Old Base Landfill (OBL) and IR Site 2, the Fire Training Area (FTA), Former Naval Training Center-Bainbridge (NTC-Bainbridge), Port Deposit, Maryland.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for OBL and FTA at the NTC-Bainbridge in Port Deposit, Maryland. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendment and Reauthorization Act (SARA) of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The Department of the Navy (Navy) selected the remedial action for OBL and FTA in consultation with the U.S. Environmental Protection Agency, Region III (EPA).

1.3 ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health, welfare, and/or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

The Navy recommends that Institutional Controls (ICs) and a long term monitoring program (LTMP) be implemented at OBL and FTA to protect human health and the environment. The Selected Remedy includes the following major components:

- **Site-specific deed restrictions preventing intrusive activities on the cap of the OBL.** No construction of any kind may commence or be accomplished at the OBL without written authorization for such activity having first been obtained from the Navy and the Secretary of the Maryland Department of the Environment. The restriction is intended to prevent any activity that could result in damage to, or erosion of the protective landfill cap. The OBL must be inspected, maintained, and monitored in accordance with Maryland Laws and Regulations for landfills.
- **A long-term ground water, surface water, and sediment monitoring program at locations downgradient of OBL, with mandatory reviews by environmental regulatory agencies**.
  The LTMP for OBL and FTA will be designed and implemented on the basis of an agreement between the Navy and the EPA Region III. The LTMP will include mandatory provisions for periodic Navy/regulator reviews. Monitoring Program Reviews will be

scheduled to occur at five-year intervals; however, the frequency of reviews can be increased at the request of either the Navy or the EPA. The Navy/regulatory reviews will include an evaluation of potential trends in the environmental analytical data collected and site-walkovers to assess the condition of the OBL cap. The Navy/regulatory review of the protectiveness of the Selected Remedy will include determinations for potential follow-on actions including potential revisions to the environmental monitoring as deemed appropriate.

- **In accordance with Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the ICs will include a clause in the transfer deed that grants the United States Navy such access to the property in any case in which a response action, or corrective action is found to be necessary on the property following property transfer.**
  ICs will provide rights of access to conduct tests, investigations, and surveys, including, where necessary, well drilling, digging test pits, boring, and other similar activities.

- **Deed restriction preventing the use of ground water at the OBL and FTA for potable water supplies.**
  Human health risk assessments conducted for OBL and FTA, as part of the Remedial Investigation (RI) and post-RI human health risk characterization, have identified unacceptable risk to human health based upon consumption and exposure to ground water under residential-use scenarios. Therefore, a deed restriction on ground water will be implemented at these sites. Any ground water wells or other use of ground water located on the sites must comply with all Federal, state, and local requirements relating to ground-water use. In addition, in the three (3) areas illustrated in Figures 2-3 and 2-4 and defined in the transfer deed, ground water shall not be used for drinking water unless the concentration of manganese has been reduced to three hundred parts per billion (300 ppb) at the user's tap and the concentration of iron has been reduced to four thousand and six hundred parts per billion (4,600 ppb) at the user's tap. Use of ground water for non-potable, industrial processes will not be restricted, however, the use of ground water for non-potable, industrial processes is assumed to not include frequent human contact. Annual inspections and IC certification reports will be prepared by the Navy to insure that the ICs have not been violated.

The restriction for ground-water use and intrusive activities at OBL, as well as the access rights will be provided in the transfer deed.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy satisfies the mandates of CERCLA §121, and to the extent practicable, the NCP. It is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action. The Selected Remedy is cost-effective and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This action does not employ treatment which reduces toxicity, mobility or volume as a principal element because the Selected Remedy, Institutional Controls, provides a better balance of trade-offs among (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility or volume through treatment, (3) short-term effectiveness, (4) implementability and (5) cost-effectiveness than an alternative remedy involving treatment. In particular, previous remedial measures (capping of OBL and removal of contaminated soil from FTA) in combination with the Selected Remedy are expected to cause ground water contaminant concentrations to decrease within a reasonable period of time without the need for expensive treatment.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above the levels that allow for unlimited use and unrestricted exposure, a mandatory statutory review will be conducted at five years intervals after the signing of the ROD, to ensure that the remedy is, or will be, protective of human health and the environment.

P G McMahon

P. G. McMAHON, JR.
Captain, Civil Engineer Corps
U.S. Navy
Commanding Officer

10 FEB 2000

Date

2. DECISION SUMMARY

2.1 SITE NAMES, LOCATIONS, AND DESCRIPTIONS

This ROD is issued to describe the Navy's selected remedial action for IR OBL and FTA, at NTC-Bainbridge, Port Deposit, Maryland.

The former NTC-Bainbridge is situated on approximately 1,185 acres in Cecil County, Maryland, just to the northeast of the town of Port Deposit (Figure 2-1).

Site 1, Old Base Landfill (OBL), is located on the northwestern boundary of the NTC-Bainbridge, separated from Route 276 by a facility fence and a small-unnamed stream (Figure 2-2). The OBL was a solid waste landfill that operated from 1942 until base closure in 1976. Disposal activities were unregulated and the landfill is unlined. Although disposal records were not kept, it is known that pesticides and asbestos-transite laden building debris were disposed at the site. In 1995 the landfill was capped as an Interim Remedial Measure (IRM). Repairs and extensions to the cap were made in 1999.

Site 2, Fire Training Area (FTA), is located on the southeastern corner of the NTC-Bainbridge and bounded by Happy Valley Branch (HVB) near Maryland Route 222 (Figure 2-2). The FTA was used to train Navy recruits in fire fighting techniques from the 1940s until the late 1960s. The training involved spraying buildings with oil and igniting them. When the flames were extinguished with water, oil and water run-off drained into two subsurface concrete vaults off the southwest corner of the concrete pad. Overflow from the vaults went into an oil-water separator pit, then through a subsurface valve and piping system discharging into a shallow ditch leading to HVB. Remediation, conducted during 1994-1995, was completed as an IRM and included the excavation of 37,950 cubic yards of oil, debris, and pesticide-contaminated soil. Soil excavated from FTA was transported to the OBL for disposal under an impermeable landfill cap. The former oil-water separator pit was restored as a wetland.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of Site Actions

NTC-Bainbridge was constructed in 1942 as a training center for World War II Navy recruits. The facility was partially deactivated after World War II, but experienced major activity following the beginning of the Korean crisis in 1951. In the post-war years, NTC-Bainbridge became the host for various schools and functions, including the Naval Preparatory School, the Nuclear Power School, the Naval Reserve Manpower Center, WAVES Headquarters, and a U.S. Naval Hospital. Operations at NTC-Bainbridge were reduced in 1972, and NTC- Bainbridge was formally closed in 1976. The United States Navy has retained ownership, although no Navy operations have been conducted since 1976. The Department of Labor operated a Job Corp Training Center on part of the installation until 1990.

Over 700 buildings and other structures were once located on NTC-Bainbridge prior to the initiation of a building demolition project in 1990. At this time, approximately 60 structures remain onsite. NTC-Bainbridge is in a general state of disrepair, with many of the remaining buildings damaged by weather and/or vandals, and portions of NTC-Bainbridge are overgrown with vegetation.

Portions of NTC-Bainbridge are used by the Cecil County Community College Truck Driver Training School. The College maintains a truck staging and office area at Gate 14 in the northern portion of NTC-Bainbridge. Driver training exercises are conducted in the vicinity of the former warehouse area in the northern portion of NTC-Bainbridge and the large parking lot adjacent to the main station entrance along Maryland Route 222 in the southern portion.

2.2.2 Previous Investigations and Response Actions

In 1987, OBL and FTA were identified by Atlantic Division, Naval Facilities Engineering Command, as areas where environmental contamination may have resulted from past NTC-Bainbridge operations and disposal practices. Versar, Inc.(1988) performed a hydrogeologic investigation in 1988 to assess potential impacts to surface water, ground water, and stream sediments from prior Navy activities. The objectives of the Versar study were to document potential contaminant releases and characterize the extent of contaminant migration as applicable. Volatile organic compounds (VOC) were reported in ground-water samples collected from monitoring wells at OBL and FTA, and pesticides were reported in sediment samples collected down gradient from OBL. Petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAH) were reported in sediment samples collected from FTA.

In 1990, an RI for OBL and FTA was initiated for the Navy by Ecology and Environment (E&E 1999b). The objectives of the RI effort were to identify contaminant sources by sampling soil, water and sediment; to determine the extent of contaminant migration into ground water by installing monitoring wells; and to use field data to determine the potential or actual health and environmental effects of past hazardous material disposal practices at each site. Initial fieldwork for the RI was conducted in 1990 and 1991. A second phase, conducted between 1993 and 1994, was added to fully characterize the nature and extent of contamination at both IR Sites. The Navy initiated IRMs at both sites prior to finalization of the RI/Feasibility Study (FS) report in 1999. Human and ecological risk assessments were conducted in 1994 prior to completion of the IRMs, and again in 1999 several years following IRM implementation.

IRMs were completed from July 1994 to June 1995 and included delineation of contamination, removing contaminated soils from FTA, consolidating outlying contamination from around the landfill, capping the OBL, and conducting confirmation sampling by OHM Remediation Services Corporation (OHM). The purpose of these IRMs, among other things, was to (1) prevent direct contact with contaminants in the landfill and to prevent water from infiltrating the landfill, which could cause contaminants to migrate into the ground water; and (2) remove the source of contamination at the FTA. The Navy expected that following these actions, the levels of contamination in the ground water underneath the OBL and the FTA would gradually decrease.

The analytical results of the RI investigation were combined with the analytical results of the IRM confirmation sampling and used to assess ecological and human health risks. The RI was finalized in February 1999, and included human health and ecological risk assessments based upon both pre- and post-IRM conditions.

Based upon conclusions reached within the RI, it was recommended that an FS be conducted. The FS considered remedial measures for reducing any remaining risks not already addressed by the IRMs. Information from the RI was used to develop cleanup options for the FS.

The purposes of the FS were to evaluate and screen options, and develop cleanup alternatives for OBL and FTA. Remedial Action Objectives (RAOs) were identified and used as the basis for preparing remedial action alternatives. Specifically, human health and ecological risks were re-evaluated, cleanup goals based on the risks were generated, and applicable remedial alternatives and associated cost were prepared.

Additional sampling was conducted in 1999 in order to support an additional Human Health and Ecological Risk Characterization (HERC) for the OBL and FTA. The purpose of the HERC was to assess the human health and ecological risks that remained following the IRMs and to update the risk assessments performed as part of the RI. The results of the 1999 sampling showed that, with a few exceptions, the levels of contamination in the ground water underneath the OBL and FTA had, in fact, decreased as the Navy expected. Unacceptable human health risks from drinking ground water, however, remain at both sites. Although cancer risks were within acceptable limits, unacceptable non-cancer health risks due primarily to iron and manganese, were identified at both locations. Based on the results of the HERC unacceptable ecological risks were identified in surface water immediately downgradient of the OBL. The unacceptable ecological risks at OBL in 1999 were driven by several organic and inorganic constituents of potential concern (COPC) in sediment, and the potential for COPC contribution from State Route 276 was noted. The 1999 analytical surface water and sediment sample results at FTA show that it is unlikely that aquatic life would be at risk from contaminants. Following the IRMs (i.e., landfill cap at OBL and removal action at FTA) the areal extent of maximum contaminant levels (MCL) exceedances in the aquifer has decreased. Only one Primary MCL exceedance (chlorobenzene) was reported in a sample at the OBL during the 1999 sampling.

2.2.3 Enforcement Activities

No enforcement actions have been taken at OBL and FTA. The Navy has owned the property since 1942 and is identified as the responsible party.

2.3 COMMUNITY PARTICIPATION

The Proposed Remedial Action Plan (PRAP) for OBL and FTA at NTC-Bainbridge was released to the public for comment in October 1999, in accordance with the requirements established in CERCLA § 117(a) and NCP found at 40 CFR § 300.430(f)(2). These documents were made available to the public in the Administrative Record maintained at the Washington Navy Yard in Washington, D.C. and at the information repositories in Port Deposit and Elkton branches of the

Cecil County Library. The public comment period extended from 20 October 1999 to 19 November 1999.

In addition, two public information sessions were held at the Bainbridge Elementary School in Port Deposit, Maryland on 10 November 1999, in accordance with Section 117(a) (2) of CERCLA, 42 U.S.C. Section 9617 (a) (2). The first public information session was held from 2:30 PM to 4:00 PM; the second session was held from 7:00 PM to 8:30 PM.

A summary of comments received is given in the Responsiveness Summary at the end of this ROD.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

The Selected Remedy is intended as a follow-on action to the 1994/95 IRM implementation. Draft human and ecological risk assessments completed by E&E revealed unacceptable human and ecological risk levels and as noted in Section 2.2.2. IRMs were implemented to provide immediate response. Wastes at the OBL were consolidated and a cap was engineered and installed to prevent direct exposures and to limit infiltration of precipitation and leaching of waste material. Organic waste resulting from former fire training activities at the FTA was removed from the soil. Post-IRM environmental sampling has shown significant reductions in contaminant levels over time. However, post-IRM human and ecological risk assessments have shown that unacceptable non-carcinogenic risks due to drinking ground water remain. The unacceptable risks are driven by elevated levels of iron and manganese in ground water at both IR Sites.

The selected remedy presented in this ROD is intended to compliment the previously implemented IRMs as a comprehensive response to protect human health and the environment.

Deed restrictions that prohibit the use of ground water as a source of potable water will block the pathway to human receptors eliminating current and potential threats to human health. The site-specific deed restrictions that prevent the intrusive activities on the landfill cap are necessary to protect the long-term integrity of that barrier in preventing the mobilization of landfill related contaminants and migration of contaminants to ground water. Consequently, the site-specific deed restrictions prohibiting intrusive activities provide further assurances that human health and the environment are protected in the future.

The LTMP provides further protection of human health and the environment through the development of a database to monitor Contaminants of Concern (COC). The database will be used to assess the long-term effectiveness of the IRM and may be used to support follow-on actions during subsequent regulatory reviews.

2.5 SITE CHARACTERISTICS

OBL is centrally located on the northwestern boundary of the NTC-Bainbridge, separated from Route 276 by the facility fence and a small, unnamed stream. The landfill was used for disposal of wastes from the early 1940s until the base closed in 1976. The disposal activities were unregulated and the landfill is unlined. Local soils were used for cover and trench and fill operations. Three liquid disposal pits were located in the southwest part of the landfill and one was located in the western part. Records of disposal of potentially hazardous wastes were not kept. However, it is known that, after the NTC-Bainbridge was formally closed, building debris from the demolition of transite-clad (containing asbestos) structures was placed on the surface of the northern end of the landfill and covered with a minimal soil cover. By the time of the initial Site Inspection (SI) in 1988, the site was largely covered by a growth of small trees, shrubs, and other vegetation. The areal extent of the disposal activities covered approximately 15 acres. The landfill was cleared and the waste was later consolidated into a smaller area and covered by an impermeable membrane as an IRM. COPC identified at IR Program Site 1 in 1994 and 1999 are shown in Table 2-1.

FTA is located in the southeast corner of the NTC-Bainbridge and is bounded by HVB on the southeastern border of NTC property near Maryland Route 222. The site was used to train Navy recruits in fire fighting techniques from the 1940s until the late 1960s. FTA consisted of three brick and reinforced concrete buildings set in line on the south corner of a large square concrete pad, with an adjoining clay-lined oil separator pit, southeast of the pad. There were also 10 underground storage tanks (USTs) associated with the training activities on the concrete pad. It was determined that initial drainage of oil and water off the pad was directed into two concrete subsurface vaults off the south corner of the pad. Overflow from these vaults went into the oil separator pit. All of these were subsequently remediated as an IRM between 1994 and 1995. COPC identified at IR Program Site 2 in 1994 and 1999 are shown in Table 2-2.

NTC-Bainbridge is located near the contact zone where the crystalline metamorphic rocks of the Piedmont "foothills" are overlaid by the unconsolidated sedimentary deposits of the Coastal Plain. The Coastal Plain deposits are typically stratified layers of sand, gravel, silt, and clay that overlie the crystalline metamorphic rocks forming a wedge that regionally thickens to the southeast. The sedimentary deposits feather out at the contact and at NTC-Bainbridge only exist at the northern one-third portion of the base. Due to their discontinuous nature and limited areal extent they are not principal aquifers at OBL and FTA. Hence, the fractured crystalline rocks beneath NTC-Bainbridge and the surrounding area are the primary aquifers. The crystalline rocks are relatively non-porous and their ability to store and transmit water increase as the number of fractures, the size of the fracture openings, and the interconnectedness of fractures increase.

Precipitation infiltrates the soil column and migrates vertically downward toward the soil/bedrock interface until it reaches the water table where it moves under the influence of gravity and discharges to streams, rivers, and other surface water bodies. Infiltrating precipitation can move as ground water through the weathered zone above the crystalline bedrock aquifers, discharge to surface water, or directly recharge the fracture system of the underlying aquifers. It is the storage, slow movement, and subsequent ground-water discharge that keeps streams flowing during periods of no precipitation.

Thus, streams and springs receive most all ground-water discharge from the local ground-water flow system. Conceptually, streams and springs can be viewed as no-flow hydraulic boundaries where ground water and contaminant flow paths terminate as they exit the aquifer and enter the surface water system. Consequently, OBL and FTA can be viewed as isolated sources within separate ground-water discharge basins. Both are bounded by upgradient ground-water recharge divides and downgradient by the nearby streams. For this reason, the COPC identified in ground water at OBL and FTA are believed to be localized occurrences and COPC are believed to discharge to surface water before leaving the NTC-Bainbridge site. Pieziometric and chemical quality data collected during and subsequent to the RI support this conceptual model.

Water supply wells drilled in the State of Maryland are permitted by the Maryland Department of the Environment (MDE) under Code of Maryland Regulations (COMAR) 26.04.04. Well construction standards vary based upon hydrogeologic area. The crystalline rock aquifers below NTC-Bainbridge are categorized as Hydrogelogic Area III. COMAR requires wells installed in Hydrogeologic Area III to have solid casings extending through the weathered zone to preclude the infiltration of water from that zone into the well. Direct infiltration of water from that zone is prohibited in water supply wells since water in the weathered zone is generally recognized as a potential source of contamination. Below the solid casing, water supply wells typically exist as open boreholes recharged by fractures they intersect. Fractures are typically thin and discontinuous and the probability of intersecting water bearing fractures decreases sharply below depths of 300 feet. Consequently, water supply wells generally range between 100-300 feet deep. The town of Port Deposit, located downgradient of NTC-Bainbridge uses the Susquehanna River for its source of drinking water. The intake pipe for the Port Deposit water supply, however, is located upstream of any potential NTC-Bainbridge discharges. There are no known private or public water supply wells affected by OBL or FTA.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

No future land use plan has been developed for NTC-Bainbridge, therefore potential future land uses include industrial, residential, office, retail, recreational and hotel/conference center or educational facilities.

At the OBL, in order to preserve the impermeable cap, the only permissible future use is recreation. In particular, no activity that compromises or penetrates the cap will be allowed. The use of ground water for any use other than non-potable, industrial processes will be restricted.

At the FTA, use of ground water for any use other than non-potable, industrial processes will be restricted. There are no other restrictions on the future uses of the FTA, i.e. potential future uses include industrial, residential, office, retail, recreational and hotel/conference center or educational facilities.

2.7 SUMMARY OF RI HUMAN HEALTH RISKS AT OBL AND FTA

The text that follows briefly describes the risk assessment process, and discusses risks found in the RI as well as the 1999 re-characterization of risks.

For carcinogens, human health risks are generally expressed as an individual's incremental probability of developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

where: risk = a unitless probability (e.g., 2 x 10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks that cancer individual's face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-6} to 10^{-4}.

The CDIs and SFs assumed for the COCs at the OBL and the FTA may be found in the Administrative Record for this ROD. The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where:

CDI = Chronic daily intake
RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term). The CDI and RfD assumptions are provided in the Administrative record for this ROD (for example see the RI Section 5.4).

The first phase of the RI for the OBL and FTA was conducted by E&E in 1990 and 1991, with the second phase conducted between 1993 and 1994. Data collected during these two phases were combined, and a human health risk assessment was performed.

Human populations (i.e., receptors) and exposure routes that were considered in the evaluation are bulleted below. An exposure route is a way that a person can potentially be exposed to a hazardous substance (e.g., accidentally inhaling contaminated dust, or in the case of a child swallowing contaminated soil.).

- Recreational users-incidental ingestion of and dermal contact with surface soil, sediment, and surface water;
- Residential users-incidental ingestion of and dermal contact with surface soil, subsurface soil, sediment, and surface water; ingestion of and dermal contact with ground water as well as inhalation of volatiles while showering;
- Workers-incidental ingestion of and dermal contact with subsurface soil.

Acceptable risks were found for all exposure routes with the exception that a Hazard Index (HI) greater than 1 was calculated for future ground-water users at both the OBL and the FTA. In addition, cancer risks from ingestion of ground water at the FTA equaled 10^{-4}.

Consequently, IRMs were completed by the Navy at the two IR Sites in an effort to reduce risks to acceptable levels. Additional sampling of surface water, sediment, and ground water was conducted in April 1999 and human health risks have been re-characterized, based on the analytical results of post-IRM sampling data. Because unacceptable human health risks were found only from ground water, other media examined during the RI were not reassessed.

Human Health Risks at OBL (based on data collected in 1994)

Cancer risks for all human receptor populations were evaluated and found to be within acceptable levels. The total HIs associated with ground-water use at OBL however, were 35 and 16 for the child and adult, respectively, both of which are above EPA's acceptable noncancer level of 1.0. The unacceptable HIs were due primarily to ingestion of manganese, iron, and antimony.

Human Health Risks at FTA (based on data collected in 1994)

Cancer risks due to soil exposure for all human receptor populations were evaluated and found to be within acceptable levels. Total HIs associated with residential soil exposures however, were 1.3 for the adult and 2.8 for the child, both of which are above the 1.0 benchmark level. The analytes associated with the elevated HI (chromium, iron, and manganese) have different target organs and when considered separately, only iron with an HI of 1.5 exceeded the 1.0 benchmark for the child receptor.

The estimated potential cancer risks associated with domestic use of ground water at FTA was 5.4×10^{-4} and 2.1×10^{-4} for adults and children, respectively. This exceeded the acceptable EPA range of 10^{-6} to 10^{-4}. Most of the estimated cancer risk from ground water was with ingestion of PAH and beryllium. Total HIs associated with domestic use of ground water at FTA were 16 and 37 for adults and children, respectively. The noncancer risks were driven primarily by iron and manganese. The HIs were well above the 1.0 benchmark level.

2.7.1 Summary of Post-RI Human Health Risks at OBL and FTA

As noted in previous sections the Navy initiated IRMs following submission of the 1991 draft RI that revealed unacceptable human and ecological risks at both IR Sites. At OBL, the landfill cap was expected to keep rainwater from leaching contaminants into ground water; therefore, the Navy expected contaminant levels in the ground water to decline. The Navy also expected to see a decrease in contaminant concentrations at FTA, due to Navy removal of the contaminant source. To assess the results of the IRMs, the Navy, in 1999, conducted additional sampling and analyses at OBL and FTA to re-assess unacceptable risk levels identified by E&E during the RI/FS. EA Engineering, Science, and Technology, Inc. (EA) collected additional sediment and ground-water samples in the spring of 1999. Cancer and noncancer risks were re-evaluated in the summer of 1999 to assess potential changes in the risk levels subsequent to the IRMs (EA 1999c).

EPA Region III also assessed 1999 risk levels at OBL and FTA using 1999 data. The EPA approach to assessing 1999 risk levels differed from the approach used by the Navy; however, the conclusions reached by both the Navy and EPA were similar and unacceptable non-cancer risks associated with drinking water exposures to iron and manganese were identified using both procedures.

The following summary of 1999 human health risks is presented using data generated by the EPA. The supporting documentation for the EPA risk calculations (14 December 1999) is presented in the Administrative Record.

Human Health Risks at OBL (based on data collected in 1999)

Only cancer and noncancer risks associated with ground water for future residents were re-evaluated, since these were the only risks that were found to be outside acceptable limits in the RI.

Table 2-3 shows the comparison over time of cancer risks and noncancer hazard quotients associated with ground water for future resident adults and children, respectively.

The total cancer risks associated with residential ground-water exposures at OBL were approximately 3.7x 10^{-5} and 1.9 x 10^{-5}, for future adults and children, respectively. The risks, due primarily to arsenic and vinyl chloride, are within the 10^{-6} to 10^{-4} acceptable EPA range. Total 1999 noncancer risks are 10.0 for future adult residents and 23.0 for future children residents. The noncancer risks, due primarily to ingestion of water with manganese and iron, exceed the acceptable EPA threshold of 1.0. The manganese and iron concentrations in ground water were lower than in 1994. Apparent decreases in concentrations may indicate decreasing concentrations over time.

Human Health Risks at FTA (based on data collected in 1999)

Only cancer and noncancer risks associated with ground water for future residents were re-evaluated. Risks associated with residential exposure to soil, which was found to be slightly above acceptable limits (HI=1.3 for adults, 2.3 for children), were not re-evaluated because the individual COPC have different target organs. For the adult receptor, none of the individual COPC HIs exceeded the 1.0 benchmark. For the child, only iron exceeded the 1.0 benchmark, with an HI of 1.5. By itself iron did not warrant additional evaluation since the recommended iron dietary allowance for children is 1.0 mg/kg-day (National Academy of Science [NAS] 1989), three times the reference dose used to estimate risk, and because the iron concentrations were within the range of potential background levels.

Table 2-4 shows the comparison over time, of cancer risks and noncancer hazard quotients associated with ground water for future resident adults and children, respectively.

There were no cancer risks associated with residential ground-water exposures at FTA for future adult residents since no carcinogenic COC were identified. The decrease in cancer risks between the 1999 and 1994 risk assessments is associated with the decrease in PAH concentrations from 1994 to 1999. In 1999, noncancer HIs were 9.0 for future resident adults and 21.0 for future resident children. The risks were driven by iron and manganese.

Iron and manganese were identified as COC in 1999 at both the OBL and FTA.

2.7.2 Ecological Risks

Three on-site NTC-Bainbridge streams were considered for this study (USFWS, 1999). A single 100-meter reach was used as representative of the stream at each location.

The East Branch Unnamed Tributary (EBT) is a shallow, first order stream (a primary stream that does not originate from another stream) draining the east side of the OBL. Water depths at this site are generally less than one foot. The stream flows through a mixed deciduous forested area, with the banks of the stream heavily vegetated by herbaceous and shrub type species. Instream habitat contains a mix of small riffle areas, shallow pools and an abundance of woody debris and snags. EBT drains into the West Branch Unnamed Tributary, downstream of the OBL.

West Branch Unnamed Tributary (WBT) drains the west side of the OBL and flows parallel to Rt. 276. This is a shallow first order stream on the west side of the OBL and then becomes a second order stream (a stream that originates from another stream or source) south of the OBL where the EBT meets the WBT. Water depths at this location were similar to EBT. Historically, runoff from the OBL entered the stream, however, sediment loading into the stream has recently been minimized by stabilization of the OBL banks. The portion of the stream in the study reach is channelized, with concrete replacing the natural bank for most of its length. The section of stream located on the NTC-Bainbridge property is bounded by grasses, with no forested riparian area present. Once the stream exits the NTC-Bainbridge property a marginal forested riparian area exists on the east bank of the stream. Instream habitat is uniform in nature, with few riffles and pools present. In addition, WBT receives highway runoff and its associated contaminants from Rt. 276 during precipitation events.

HVB is a second order stream that drains the FTA. It is designated as a trout propagation stream by the Maryland Department of Natural Resources. HVB flows through an extensive forested riparian area composed mostly of mixed deciduous tree species. In stream habitat is composed of riffles, pools, and an abundance of woody debris and snags.

A Desktop Ecological Risk Assessment (DERA) was performed by the U.S. Fish and Wildlife Service (USFWS) in October 1998, based on RI data gathered in 1990-1994, and limited confirmation results generated during the IRMs of 1994-1995. The report is included in the RI (E&E 1999b). The DERA evaluated risks due to contaminated sediment for four different ecological receptors using food-chain models based on ingestion of surface water and sediment by birds (the kingfisher) and mammals (the raccoon). Ecological risks were re-evaluated by EA (1999c) to assess the potential impacts from the IRMs completed during 1994 and 1995. The results suggest that the 1994/1995 IRMs have reduced contaminant exposure for ecological receptors.

Ecological Risks in 1994

The risks associated with each IR Site were based on the potential to impact ecological receptors. At the OBL, risks were inferred for all the ecological receptors: benthic life, fish, piscivorous birds, and omnivorous mammals. At the Fire Training Area, risks were inferred for piscivorous birds and omnivorous mammals only. These risks were based on sampling results of sediment and surface water and on food-chain modeling.

Ecological Risks in 1999

The assessment of ecological risks conducted in 1999 was restricted to those chemicals that were identified by USFWS (1998) as significant risk drivers, i.e., those that posed “some potential for risk.” Table 2-5 identifies the risk drivers based upon a review of the USFWS report. Tables 2-6 through 2-10 presents a comparison of the ecological risks in 1994 and risks present in1999. Ecological risks based on 1999 analytical data were found to have substantially decreased relative to 1991/1994 data in both the OBL and the FTA. Of 26 analytes screened in sediment from the OBL, HQ of all 26 decreased in 1999, most by factors greater than 20 percent, and many to levels below the lowest risk threshold (HQ=1.0) (Table 2-6). There was a similar reduction in risk in surface water at the OBL in 1999 (Table 2-7). In the food-web risk analysis at the OBL, 12 of 16 risk driver analytes for the kingfisher, and 15 of 19 for the raccoon resulted in 1999 HQs lower than corresponding values in 1991/1994 (Tables 2-8 and 2-9). Of the few food-web risk drivers identified based on 1991/1994 data at the FTA, two of three for the kingfisher and three of five for the raccoon had lower HQs in 1999 (Table 2-10). Based on hazard quotients exceeding a threshold of 10, which approximates the lowest observed adverse effect level (LOAEL), the 1999 ecological risks across sediment, surface water, and food-web exposure pathways include five pesticides and six metals at OBL. At the FTA, risks from two metals, aluminum and manganese, were inferred for piscivorous birds and omnivorous mammals only. Although ecological risks remain, the consistent reduction of ecological risks at OBL and FTA over time may reflect the ameliorating influence of remediation activities carried out in 1994.

2.8 REMEDIAL ACTION OBJECTIVES

For OBL:

- Prevent humans from consuming ground water contaminated with manganese, iron, and chlorobenzene.
- Prevent ecological receptors from being exposed to pesticides and metals in sediment and surface water.

For FTA:

- Prevent humans from consuming ground water contaminated with manganese and iron.

The RAOs determined for both sites were to reduce exposures to contaminants through each of the exposure routes to acceptable levels or restricting the routes of exposure, with respect to human exposures, or by reducing contamination concentrations with respect to ecological receptors at OBL by preventing leaching of landfill related COC.

2.9 DESCRIPTION OF ALTERNATIVES

Summarized in this section are three possible cleanup alternatives for the OBL and FTA. A detailed analysis of each alternative can be found in the FS, however the FS was finalized in the absence of 1999 analytical sample results and associated human and ecological risk. Consequently, costs for environmental monitoring at the FTA are included in the FS.

Alternative 1 – No Action. The No Action alternative is required to be evaluated under the NCP. This option would not include any type of environmental monitoring, institutional controls, or remedial action, and therefore no costs are associated with this alternative. For the OBL this would mean leaving contaminated sediments in place, and for OBL and FTA leaving ground water in its present state. The No Action alternative's primary purpose is to serve as a baseline for comparison with the effectiveness of other alternatives.

Alternative 2 – Institutional Controls. ICs are actions taken other than direct cleanup measures that would afford a measure of protection for human health from environmental contamination. Typical ICs include deed restrictions on the construction and use of private wells, well use advisories, fencing to prevent contact with contaminants, or other similar measures.

Prohibition on the use of ground water for human consumption at the OBL would be achieved through the use of a deed restriction. Any ground-water wells or other use of ground water will comply with Federal, State, and local requirements related to ground-water use. In addition, in the three (3) areas illustrated in Figures 2-3 and 2-4 and defined in the transfer deed, ground water shall not be used for drinking water unless the concentration of manganese has been reduced to three hundred parts per billion (300 ppb) at the user's tap and the concentration of iron has been reduced to four thousand and six hundred parts per billion (4,600 ppb) at the user's tap. This IC would not place a restriction on the use of ground water for industrial functions as long as the end use does not involve frequent human contact with the water. The ICs include a long-term ground-water, surface water and sediment monitoring program for the OBL. Data generated from the monitoring program will be subjected to regulatory review at the end of each 5-year monitoring period to assess the effectiveness of the Selected Remedy and determine if continued monitoring would be necessary. EPA will be included in the 5-year monitoring review process. A deed restriction would also be established to prohibit construction, excavation, or any other intrusive activity on the landfill that might disturb or damage the landfill cap. The purpose for this IC is to protect the landfill cap, which has been installed to prevent further contamination of ground water by infiltration through waste materials in the landfill. The cap also serves as a barrier to casual contact with the waste by humans and ecological receptors.

Protection of ecological receptors at the OBL is provided by deed restrictions prohibiting intrusive activities on the landfill cap which, if allowed to occur unrestricted, could lead to erosion, breaching of the cap, and transport of exposed landfill waste to surface water. In addition, erosion of the landfill cap potentially increases leaching of landfill contaminants to surface water and sediment via ground-water discharge. Furthermore, the monitoring effort will provide for direct assessment of surface water and sediment quality downgradient of the landfill.

For the FTA, prohibition on the use of ground water for human consumption at the FTA would be achieved through the use of a deed restriction. Any ground-water wells or other use of ground water must comply with Federal, State, and local requirements related to ground-water use. In addition, in the three (3) areas illustrated in Figures 2-3 and 2-4 and defined in the transfer deed, ground water shall not be used for drinking water unless the concentration of manganese has been reduced to three hundred parts per billion (300 ppb) at the user's tap and the concentration of iron has been reduced to four thousand and six hundred parts per billion (4,600 ppb) at the user's tap. This IC would not place a restriction on the use of ground water for industrial functions as long as the end use does not involve frequent human contact with the water.

RAOs would be achieved under Alternative 2 immediately and would be coincident with property transfer. If any COC concentration, in the area impacted by the OBL and FTA sites, is greater than the concentrations in the Performance Standards Table in Section 2.13 of this ROD, then the Navy shall implement a remediation plan that achieves those concentrations. The estimated costs associated with Alternative No. 2 at OBL and FTA are shown in Table 2-11.

Alternative 3 – Active Remediation/Treatment. This alternative entails using remedial technologies or techniques to directly clean up contaminated sites. Treatment methods can include ground-water extraction, air stripping, precipitation/coagulation/flocculation, sedimentation, and sediment excavation and disposal.

For the OBL, ground water would be extracted from existing wells and treated to cleanup goals. Contaminated sediments identified as posing an ecological risk would be excavated, transported, and disposed of at an off-site Treatment, Storage, and Disposal (TSD) facility. Although the potential impacts of sediment excavation and removal in the streams downgradient was not evaluated as part of this alternative, it should be noted that the removal action could be disruptive to the existing habitat, causing more harm to the environment than leaving the contaminated sediment in place. For the FTA, ground water would be extracted from existing wells and treated to cleanup goals before being released to surface water streams in accordance with State and/or Federal regulations. It is estimated that RAOs could be achieved within 2-3 years under Alternative 3, assuming that an action would be preceded by an environmental impact assessment.

The estimated costs associated with this alternative at OBL and FTA are shown in Table 2-12.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The three alternatives for OBL and FTA were evaluated based upon the following nine criteria established in the NCP. The first two are known as threshold criteria, which an alternative must meet in order to be eligible for selection. The next five are known as balancing criteria that permit trade-offs between alternatives so that the best option will be chosen, given site specific data and conditions. The final two are known as modifying criteria that are used to finalize the remedy selection. Each criterion and a comparison of alternatives are described below.

2.10.1 Threshold Criteria

Overall Protection of Human Health and the Environment. Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

Alternative 1 (No Action) would not effectively reduce future risk to human health and the environment at the OBL and FTA. With no reduction in contaminant concentrations and no restriction on future land use, adequate protection of human health and the environment would not be achieved. Since this criterion is not met for this alternative, it cannot be selected as the remedy for the OBL and FTA.

Alternative 2 would provide adequate protection to human health since the future use of ground water for human consumption would be prohibited by the placement of deed restrictions on the potable use of ground water. Human health protection would also be provided by the deed restriction, that prohibits intrusive activity on the landfill cap, thus avoiding the potential for human contact with the buried wastes. Alternative 2 also provides protection to ecological receptors. Prohibiting intrusive activities on the landfill cap prevents erosion and transport of landfill waste to the downgradient streams. Prohibition of intrusive activities on the landfill cap also minimizes leaching of landfill contaminants (via ground-water discharge) to surface water and sediment.

As required under CERCLA, risks to the environment were considered. In the 1998 DERA, sediments in the streams along the landfill were identified as risks to benthic life, fish, fish-eating birds, and omnivorous animals. More recently, an Ecological Assessment Using the Rapid BioAssessment Protocol was performed (USFWS 1999). It stated that a low level of biological health was noted for the WBT (along route 276). The major influencing factor was the stream bank stabilization using concrete. Also cited was the close proximity to State Route 276 and the likely impact of surface runoff on aquatic biota. The companion-monitoring program can continue to track ecological contaminants of concern in the stream.

The 1999 HERC report shows that levels of most contaminants in all media are already decreasing. At this time it is uncertain if the observed decreases represent an environmental trend, if contaminant levels have stabilized, or if COC decreases are part of a natural fluctuation process. Until that question can be answered with certainty, it would be premature to undertake a sediment removal project at IR Sites 1 to address ecological risks.

Alternative 3 would satisfy the first Threshold evaluation criteria of protecting human health and the environment at OBL and FTA. Contaminated ground water would be pumped from the ground and treated before being discharged to the surface; contaminated sediments would be excavated from the OBL streambeds and would be transported to an appropriate waste management facility for proper disposal. As noted above however, the potential negative impacts associated with a sediment removal action in the stream downgradient from OBL were not evaluated.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Because no active remediation would take place under *Alternative 1*, there are no action specific ARARs for Alternative 1. No chemical-specific ARARs have been identified for the sediments at the OBL. One major ARAR that has been identified for ground water is the Federal Safe Drinking Water Act, which establishes Maximum Contaminant Levels permissible in drinking water provided to humans from public water supplies.

The Navy expects that the second Threshold Criterion will be achieved within a reasonable time under *Alternative 2.* Although the analytical results of the 1999 sampling effort revealed a MCL exceedance of chlorobenzene in ground water, the Navy expects that the MCL for chlorobenzene will be met within a reasonable time because the Navy has capped the OBL. Chlorobenzene concentrations appear to have decreased since 1995, when the cap was installed. The LTMP and periodic reviews will ensure that chlorobenzene concentrations are properly monitored in the future. The prohibition of intrusive activities on the landfill cap minimizes infiltration of precipitation through the landfill waste providing additional assurances that MCLs will not be exceeded in the future.

Alternative 3 is expected to meet all Federal and State, chemical-specific, location-specific, and action-specific ARARs.

2.10.2 Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation, and the adequacy and reliability of controls.

Alternative 2 does not include removal of contaminated soil/sediment or treatment of contaminated ground water. For the OBL effective removal actions were previously completed during implementation of IRMs. The deed restrictions preventing intrusive landfill activities provide long-term effectiveness by preventing direct human and ecological contact with landfill wastes. The IC monitoring plan provides the mechanism to assess and ensure the ultimate effectiveness and permanence of this remedy.

The deed restriction for potable ground-water use provides both an effective and permanent remedy to address the unacceptable non-carcinogenic human health risks associated with the elevated levels of iron and manganese in ground water.

Five-year regulatory monitoring reviews that evaluate the effectiveness of Alternative 2 are mandatory because hazardous substances would remain on-site in concentrations above health-based levels.

Alternative 3 provides a permanent and effective long-term remedy by treating contaminated ground water. However, removing contaminated sediment from the streams may disrupt habitat.

Reduction of Toxicity, Mobility or Volume through Treatment. Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of the remedy.

Alternative 2 provides no active reduction of toxicity, mobility, or volume through direct treatment however, decreases in contamination in ground water and sediment are expected to occur as the previous IRMs continue to prevent contamination from entering ground water and sediment.

Reductions in toxicity, mobility, and/or volume through treatment would be expected under *Alternative 3*.

Short-Term Effectiveness. This criterion addresses the impacts of an alternative during the construction and implementation phase until remedial response objectives are met. Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 2 best achieves the short-term effectiveness criterion since it can be implemented quickly by filing a deed with effective restrictions on use of ground water and intrusive activities on the landfill cap. There would be no short-term health risk from site disturbance activities. There would be risks to workers during monitoring, which would be addressed with proper health and safety procedures.

Alternative 3 could pose an increased risk to onsite construction and maintenance workers during ground-water treatment and sediment excavation activities. In addition, excavation of sediment may, in fact, result in further degradation of the aquatic habitat in the stream. Other short-term impacts include minor noise disturbances, truck traffic, and dust generation in the construction of the treatment system.

Implementability. Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternative 2 would pose no implementability problems. Implementation of ICs is technically and administratively feasible. There are potential problems with effectively monitoring and enforcing deed restrictions, but they can be minimized by the Navy's IC monitoring plan.

Implementation of *Alternative 3* involves some minor obstacles associated with discharge piping, stream/ditch flow diversion, and ground-water treatment field tests that need to be addressed.

Cost. This criterion addresses the cost of each remedial alternative by accounting for an estimation of capital, operations and maintenance, institutional costs, and a present worth analysis.

The total present worth of Alternatives 2 and 3 has been calculated for the comparative purposes and is presented below. The costs presented in Tables 2-11 through 2-14 are based on the FS completed by E & E (1999) prior to the completion of the 1999 sampling and analyses, and additional risk assessment. Since then, the ground water monitoring plan has evolved and the final long term monitoring has not yet been agreed upon by the Navy and the EPA. It is anticipated, however, that the costs for the long-term ground water monitoring will range between $18.000 and $35,000 annually. Costs presented in Tables 2-11 and 2-12 for Alternatives 2 and 3, respectively, reflect those originally presented in the FS.

Estimated Cost of Alternatives

Alternatives	Total Present Worth Cost
Alternative 1	Not applicable
Alternative 2	Expected to range between $18,000 and $35,000 annually.
Alternative 3	$1,279,000 (Includes initial capital costs for OBL and FTA, operation and maintenance over 5-year period)

2.10.3 Modifying Criteria

State Acceptance. The MDE has deferred regulatory oversight of OBL and FTA to EPA.

Community Acceptance. A 30-day public comment period on the PRAP was held from 20 October 1999 to 19 November 1999. A public information session was also held on 10 October 1999. All comments received are shown in Section 4. Responsiveness Summary.

Negative comments were directed to issues regarding the OBL. They include; concerns that a landfill cap is an inadequate remedial action and prone to failure, that 5-years of ground-water monitoring is not adequate, that the Navy should retain ownership of both landfills at the NTC-B, and that the Navy has not provided adequate assurance for timely and diligent future remedial action.

Detailed Navy response to each comment is also provided in Section 4. In general, the Navy feels that those comments and associated recommendations are well intentioned but, may be based on incomplete or inaccurate information. The Navy has invested heavily for surface repairs to promote the longevity of the cap to ensure that it continues to function as an impermeable barrier that isolates the waste material and prevents infiltration. Five years of ground-water monitoring is the starting point for the LTMP, subject to review and evaluation in statuary (5-year) reviews. Future ownership of the landfills is an issue that will not be decided in this ROD.

Other comments received during the comment period concerned future use of land and buildings at the NTC-B. The Navy will defer all such issues to the future property owners.

2.11 THE SELECTED REMEDY

This section lists the Selected Remedy for OBL and FTA. A limited discussion of the prime alternatives and the evaluation criteria applied has been provided in the previous section. A detailed analysis of all the alternatives and reasons why other alternatives were not selected and can be found in the FS.

Institutional controls (Alternative 2) have been identified as the Selected Remedy based upon comparison of the three alternatives developed in the FS with the threshold, modifying, and balancing criteria required under CERCLA. The IC alternative addresses unacceptable human health risks associated with elevated iron and manganese in ground water at OBL and FTA by establishing deed restrictions preventing potable ground-water uses. ICs restricting intrusive activities at the landfill will also protect human health and the environment, preventing direct contaminant exposure to human receptors, and indirect exposure to ecological receptors by preventing erosion and transport of landfill waste to the downgradient streams. Restricting intrusive activities on the landfill prevents further ground-water degradation providing another indirect layer of protection to both human and ecological receptors. The LTMP for ground water, surface water, and sediment at OBL provides the mechanism to ensure the effectiveness of the OBL deed restrictions. Mandatory regulatory reviews will be used to determine the need for further action, including monitoring.

2.12 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy is the most effective of the alternatives considered in the FS (E&E 1999). This action does not employ treatment, which reduces toxicity, mobility, or volume as a principal element, since the previously implemented IRMs satisfied that criterion.

Because this remedy will result in potentially hazardous substances remaining in onsite ground water above the levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation to ensure that the remedy is, or will be, protective of human health and the environment.

2.13 SUMMARY OF PERFORMANCE STANDARDS

- Within 5 years from the execution of this ROD, COC concentrations in ground water must equal or be less than the concentrations provided in the Performance Standards Table below. If any COC concentration, in the areas impacted by the OBL and FTA sites as illustrated in Figures 2-3 or 2-4 and defined in the transfer deed is greater than the concentrations shown in the Performance Standards Table, then the Navy shall implement a remediation plan that achieves those concentrations.

PERFORMANCE STANDARDS	
COC	Concentration (μg/L)
Chlorobenzene	100
Iron	4,600
Manganese	300

- The Navy shall submit a ground-water monitoring plan for EPA concurrence within 6 months of execution of this ROD.
- Within 6 months of execution of this ROD, the Navy shall submit a plan for ensuring compliance with the ground-water restrictions at OBL and FTA in addition to IC prohibiting intrusive activities on the landfill cap. At a minimum, the plan shall call for yearly inspections and a report to EPA, certifying that the restrictions are in place, effective and

protective of human health or, if the restrictions are not in place or not effective or not protective, then stating the steps to be taken to ensure that restrictions are in place, effective and protective, along with a schedule for taking these steps. (Ensures protectiveness of the Selected Remedy at these two sites.)

- Placing proper language in the deed to restrict the use of ground water and intrusive activities that may damage the cap.

3. REFERENCES

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4. RESPONSIVENESS SUMMARY

Proposed Plan and Record of Decision
IR Sites 1 and 2
Former Naval Training Center - Bainbridge

In accordance with requirements established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a public comment period that extended from October 20 to November 19, 1999 was held for the Proposed Remedial Action Plan for the Old Base Landfill (OBL) and Fire Training Area (FTA) (Sites 1 and 2) at the Former Naval Training Center – Bainbridge (NTC-B). Two letters with identical comments were submitted to EPA by the Bainbridge Development Corporation and the Board of Cecil County Commissioners. Those comments are quoted below in italics; the Navy responses to comments follow in bold text. A single written comment was submitted at the Public Information Sessions held for the Proposed Plan at the Bainbridge Elementary School on November 10, 1999. That comment is presented at the end of this section.

1. *The old landfill on the N.T.C. poses the most significant long-term environmental concern because of its location and content. The landfill is located upland and almost immediately adjacent to the Town of Port Deposit, the Susquehanna River, and the headwaters of the Chesapeake Bay. Its contents are undocumented. The Navy and the EPA have determined ground water contamination originating from the landfill. The proposed remedial action in the ROD is deficient on two (2) counts:*

   The OBL operated as a sanitary landfill servicing the former NTC-B from 1942 to 1976. During this period, wastes from the NTC-B were placed in the landfill. The Preliminary Assessment, Hydrogeological Investigation of Waste Disposal Sites, Removal Action Closeout Reports, Remedial Investigation, Human and Ecological Risk Characterization Report, and the Environmental Baseline Survey have gathered information on the OBL, its operation and contents, and its effect on contamination released to the environment.

   A. The remedial action of a WATER TIGHT CAP to prevent future leaching of surface water through the fill has proven to be inadequate, insufficient, and prone to failure. Note the recent partial failure during Hurricane Floyd. Has the ground water around the landfill been monitored since Floyd? Has there been an increase in contaminants?

   Groundwater contamination has been determined to be present at the OBL site. A network of monitoring wells has been installed both upgradient and downgradient of the OBL. Monitoring of these wells over an eight year period (1991-1999) has shown a decreasing trend in groundwater contamination. Inspections and monitoring by the Navy indicate that the cap system of the landfill is working as intended and designed.

   EPA considers capping to be a presumptive remedy for landfills, that is, it is the preferred remedy which would normally be applied first; only after the presumptive remedy had been reviewed for its effectiveness would further remedial actions be implemented.

   In September, 1999, the landfill successfully weathered in excess of a "100 year storm" in Hurricane Floyd, even though the new drainage features being installed by the repair

project had not yet been fully implemented. During this storm event, only minor erosion was noted on uppermost layer of soil on the cap system, and that was immediately repaired. In short, the landfill cap did not fail. Rather, the fact that the incomplete drainage features weathered the storm so well only validates the current design and its ability to withstand massive storms in the future.

Additional groundwater monitoring was not performed after the hurricane, but the initial 5 year monitoring program will be initiated in 2000.

B. The assurance the Navy can provide for the corrective and remedial action needed in a TIMELY and diligent manner is lacking.

The Navy has completed all studies and remedial at the OBL and FTA sites in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), in coordination with EPA Region III and the Maryland Department of Environment. Under CERCLA, and further reinforced in the terms of the transfer deed, the Navy is legally bound to respond to releases or threatened releases of past environmental contamination at these sites into the future, regardless of ownership at the time. The Navy's ability to respond in a timely manner is further enhanced by the deed clause requiring the future owner to notify the Navy upon discovery of any known or suspected contamination release.

With the integrity and mission of the CAP compromised, the Navy's commitment to simply monitoring the wells for five years is inadequate. The State of Maryland requires a closed landfill to monitor ground water for 30 years, the Navy's proposal for a five(5) year monitoring is inadequate; the Navy's proposal to pass on monitoring and inspection to some potential future BUYER is inconsistent with logic. The Navy must continue the responsibility of monitoring the landfill.

As stated in the response to comment (1a), the integrity of the cap system has not been compromised. Repairs in 1998-1999 were undertaken to correct surface erosion problems for the soil cover layer above the impermeable cap, and the impermeable cap has continually functioned for its intended purpose since first installed in 1995. The State of Maryland requirements quoted in your comment apply to a permitted landfill. As the OBL was constructed, operated, and eventually ceased operation prior to these regulations and requirements, they do not strictly apply to this site, but merit consideration. The Navy's proposed action for an initial five year monitoring program with a statutory review at the end of five years is in accordance the National Contingency Plan, and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), section 121(c), which is the law under which remedial actions were taken at the OBL site. Whether future monitoring or other action is required will be determined at the mandated 5 Year Review, and will be reassessed at each subsequent statutory review.

The Navy has clearly stated its intention that the future property recipient, as a result of transfer, will have certain obligations for operations and maintenance at the OBL site. As discussed in the response to 1.(b) above, under CERCLA and the terms of the deed, the Navy's obligations for releases or threatened releases of past environmental contamination will continue into the future, regardless of property ownership. Apart from the responsibility for contamination releases under CERCLA, other terms, conditions, and future responsibilities will be determined by the terms to the property transfer.

The Bainbridge Development Corporation strongly recommends that the ROD determinations require the Navy to maintain ownership of both the old and NEW landfills.

A ROD is a remedy selection document. The ROD does not provide determinations for ownership of the sites.

On November 10, 1999, the Navy held two pubic information sessions at the Bainbridge Elementary School in Port Deposit, Md. The purpose was to provide an opportunity for the public to gain additional information and ask questions on the proposed plan for Sites 1 and 2, and in general, to update the community on the latest cleanup and property transfer developments for the entire installation. Attendees at the information sessions were given the opportunity to provide feedback and ask questions in written format. The following two questions/comments were received in the comment drop box:

Question: *What can we do to find out who we see or talk to, to be able to get a cemetery and a building for Bainbridge articles?*

Concerns or suggestions for future land use should be directed to the Bainbridge Development Corporation (BDC):

Bainbridge Development Corporation **410-287-6060, ext 760**
Suite 400N
One Seahawk Drive
North East, MD 21901

The US Department of Veterans' Affairs manages most veterans' cemeteries, and that would be a logical starting point for such an initiative. However, the US Navy will neither support nor oppose particular plans for reuse of the former NTC. With transfer of the property to BDC scheduled, the Navy is no longer considering new requests for leases. Any request for use of an existing building at Bainbridge should also be directed to the BDC.

Comment: Very nice displays.
I hope this land is put to good use.
(signed) An ex-WAVE from WWII

The Navy has no role in the selection of future land use, but to the maximum extent practical, the NTC-Bainbridge property will be transferred without restrictions on future use.

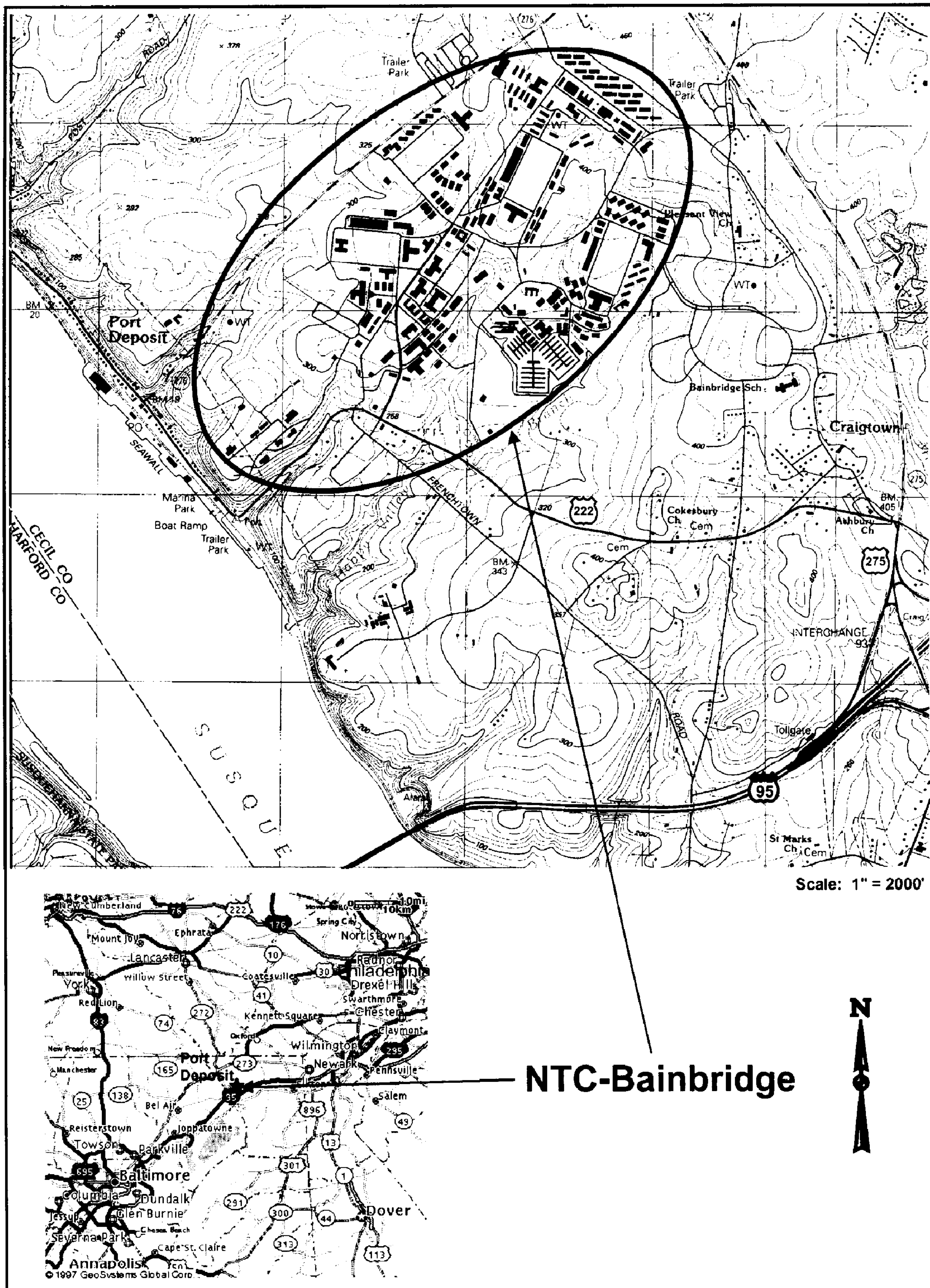

Figure 2-1. Location Map of Naval Training Center - Bainbridge.

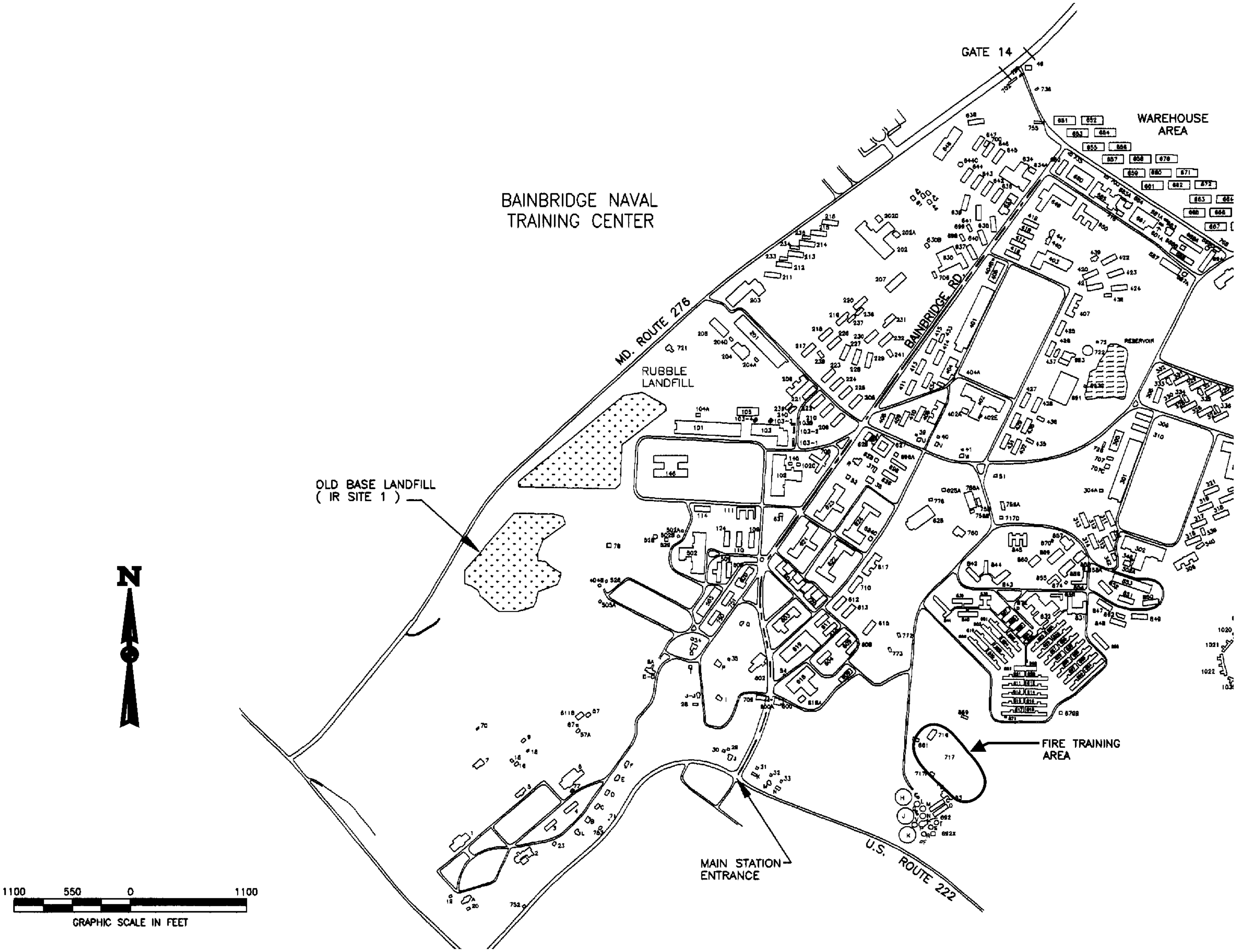

Figure 2-2. OBL and FTA Locations
Naval Training Center - Bainbridge
Record of Decision.

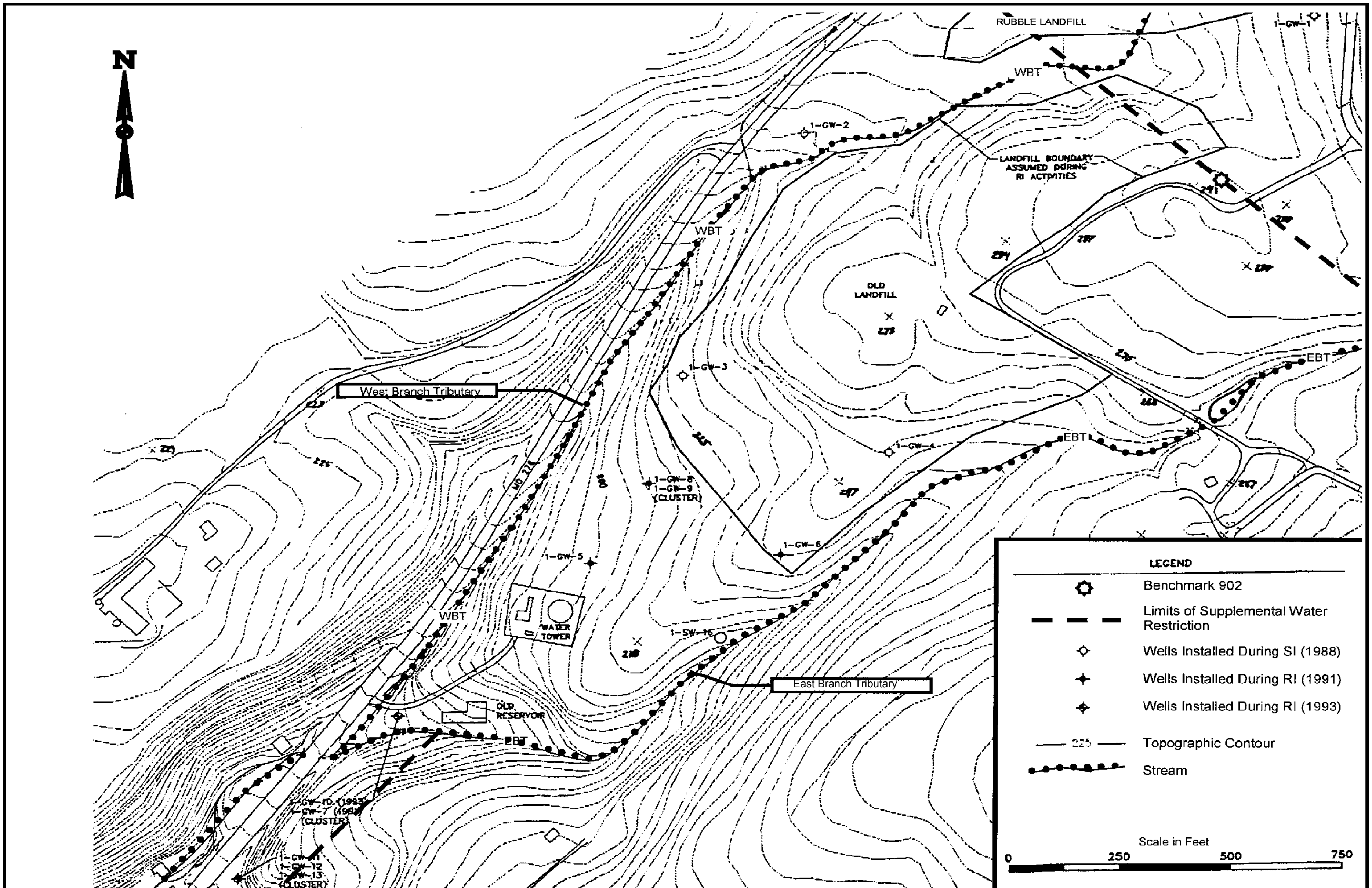

Figure 2-3.
Naval Training Center - Bainbridge
Old (Sanitary) Base Landfill
Record of Decision

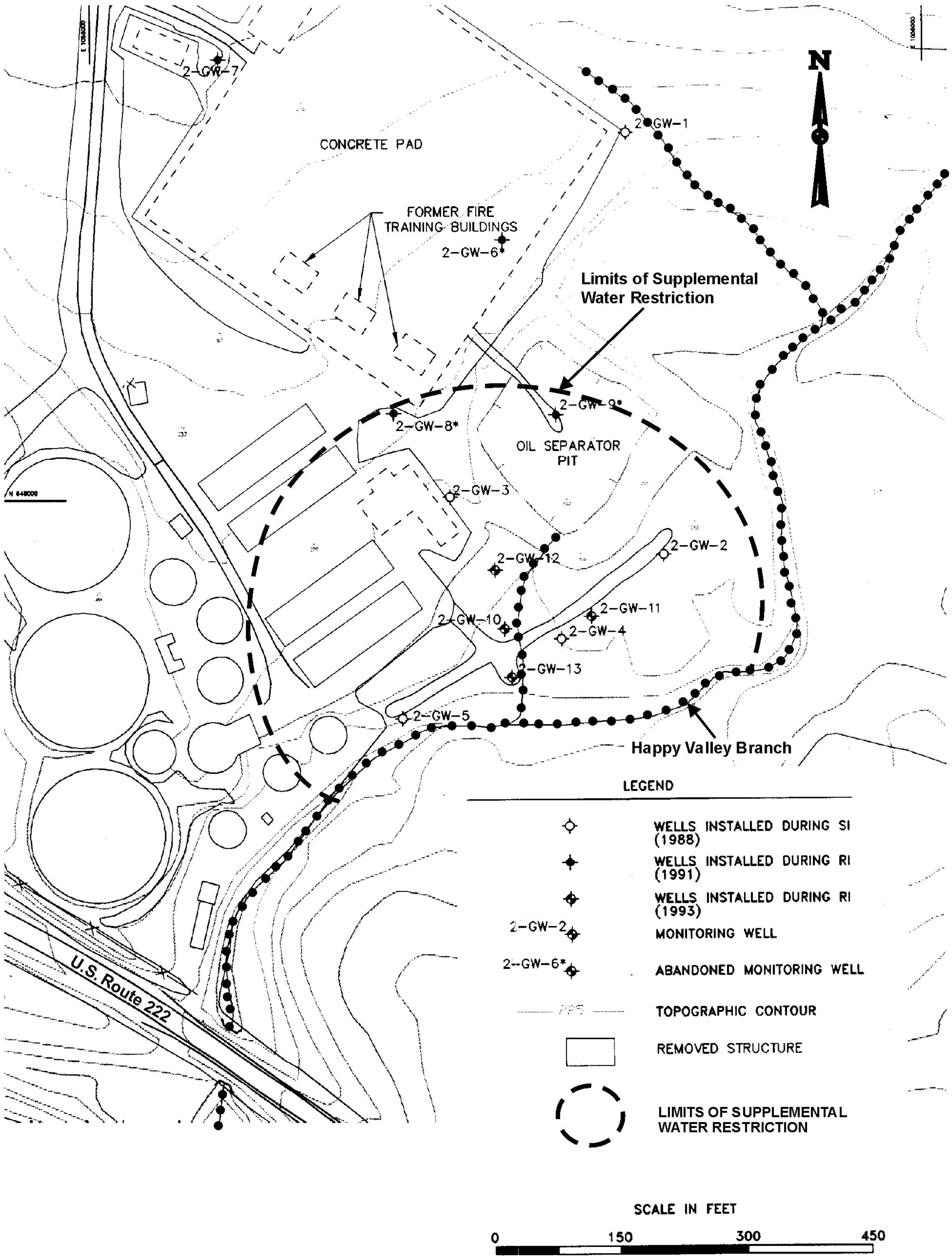

Figure 2-4.
Naval Training Center - Bainbridge
Fire Training Area
Record of Decision

TABLE 2-1 CONSTITUENTS OF POTENTIAL CONCERN IDENTIFIED AT IR SITE 1, OLD BASE LANDFILL

COPC IDENTIFIED	SEDIMENT SAMPLES 1994 E&E MAX CONC	SEDIMENT SAMPLES 1999 EA MAX CONC	GROUND-WATER SAMPLES 1994 E&E MAX CONC	GROUND-WATER SAMPLES 1999 EA MAX CONC	SURFACE-WATER SAMPLES 1994 E&E MAX CONC	SURFACE-WATER SAMPLES 1999 EA MAX CONC
INORGANICS	**(mg/kg)**	**(mg/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
Aluminum[n]	9,680	15,400	4,450	184 B	399,000	284
Antimony[n]	NA	NA	32.4	3.3 B	58.7	1.9 B
Arsenic[c]	2.0	6.9	2.3	2.1 J	44.7	3.2 J
Beryllium[c]	3.3	0.59 B	0.3	0.21 U	40.5	0.21 U
Cadmium[n]	3.1	0.87 U	3.6	0.26 U	21.1	0.26 U
Chromium[n]	49.4	49 J	241	2 J	532	1.4 J
Iron[n]	192,000	39,100	37,350	32,600	833,000	8,370
Lead[n]	387	110 L	13.7	2.3 J	1,360	3.9 J
Manganese[n]	5,600	608	6,970	5,470	15,600	2,460
Nickel[n]	57.1	217	181	14.3 J	614	29.9 J
Thallium[n]	ND	1.7 B	2.1	8 B	ND	4.49 U
Vanadium[n]	68	44.2 J	18.3	2.4 B	1,130	1.4 B
PESTICIDES	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
Chlordane[c]	690	NA	NA	NA	NA	NA
Heptachlor[c]	140	12 U	0.055	0.06 J	NA	0.06 U
SEMIVOLATILE ORGANICS	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
1,4-Dichlorobenzene[n]	93	NA	28	NA	9	NA
Benzo(a)anthracene[c]	47,000	490	ND	0.2 UJ	NA	0.3 UJ
Benzo(a)pyrene[c]	54,000	670 J	ND	0.2 UJ	NA	0.3 UJ
Benzo(b)fluoranthene[c]	74,000	730 J	ND	0.2 UJ	NA	0.3 UJ
Benzo(k)fluoranthene[c]	35,000	160 J	ND	0.2 UJ	NA	0.3 U
Dibenz(a,h)anthracene[c]	9,100	68	NA	0.2 UJ	NA	0.3 UJ
Di(2-ethylhexyl)phthalate[c]	1,100	NA	25	NA	22	NA
Indeno(1,2,3-cd)pyrene[c]	38,000	440 J	ND	0.2 UJ	NA	0.3 UJ
VOLATILE ORGANICS	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
1,2-Dichloroethene[n]	NA	NA	120	34	12	2 U
1,2-Dichloropropane[c]	NA	14 U	1B	1 U	NA	1 U
Benzene	NA	14 U	NA	0.8	NA	1 U
Chlorobenzene[n]	NA	14 U	370	170	15	6
Chloroform[c]	5	14 U	4	1 U	8.5	1 U
Methylene chloride[c]	ND	56 J	97	1 B	NA	4 J
Trichloroethene[c]	26	14 U	24	4	8	1 U
Vinyl chloride[c]	NA	14 U	2.8	1	NA	1 U

[c] Cancer ND Not detected J Estimated B Found in Blank L Analyte present. Reported values may be biased low.
[n] Noncancer NA Not analyzed U Non-detected UJ Non-detected.

TABLE 2-2 CONSTITUENTS OF POTENTIAL CONCERN IDENTIFIED AT IR SITE 2, FIRE TRAINING AREA

COPC IDENTIFIED	SEDIMENT SAMPLES		GROUND-WATER SAMPLES		SURFACE-WATER SAMPLES	
	1994 E&E MAX CONC	1999 EA MAX CONC	1994 E&E MAX CONC	1999 EA MAX CONC	1994 E&E MAX CONC	1999 EA MAX CONC
INORGANICS	**(mg/kg)**	**(mg/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
Aluminum[n]	3,710	2,230	10,500	132 B	335	982
Antimony[n]	NA	NA	ND	3.1 J	ND	1.81 U
Arsenic[c]	0.83	0.97	2.1	2.9 B	ND	4.1 J
Beryllium[c]	0.38	0.16 B	6.3	0.21 U	ND	0.21 U
Cadmium[n]	1.3	0.18 U	5.6	0.26 U	ND	0.26 U
Chromium[n]	7.2	4.2 J	28.6	1.6 B	3.5	2.9 J
Iron[n]	8,070	5,400	79,200	39,400	457	2,760
Lead[n]	209	5 L	5.8	3.5 J	4.7	4.9 J
Manganese[n]	477	176	5,500	3,870	42.1	1,300
Nickel[n]	9.7	13.3	18.6	1.6 J	6.4	2.3 J
Thallium[n]	ND	0.34 U	1	11.9 B	ND	5.7 J
Vanadium[n]	13.2	6 J	14	2 B	ND	3 B
PESTICIDES	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
Chlordane[c]	ND	NA	NA	NA	NT	NA
Heptachlor[c]	ND	2 U	ND	0.05 U	NT	0.06 U
SEMIVOLATILE ORGANICS	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
1,4-Dichlorobenzene[n]	ND	NA	1	NA	ND	NA
Benzo(a)anthracene[c]	150	65 J	1	0.2 U	NA	0.3 UJ
Benzo(a)pyrene[c]	70	54 J	2	0.2 U	NA	0.3 UJ
Benzo(b)fluoranthene[c]	140	99 J	3	0.2 U	NA	0.3 UJ
Benzo(k)fluoranthene[c]	40	21 J	2	0.2 U	NA	0.3 U
Dibenz(a,h)anthracene[c]	ND	8	NT	0.2 U	NA	0.3 UJ
Di(2-ethylhexyl)phthalate[c]	110	NA	110	NA	6	NA
Indeno(1,2,3-cd)pyrene[c]	72	26	2	0.2 U	NA	0.3 UJ
VOLATILE ORGANICS	**(ug/kg)**	**(ug/kg)**	**(ug/L)**	**(ug/L)**	**(ug/L)**	**(ug/L)**
1,2-Dichloroethene[n]	NA	NA	2	0.6	ND	2 U
1,2-Dichloropropane[c]	NA	7 U	ND	1 U	NA	1 U
Chlorobenzene[n]	NA	7 U	ND	1 U	ND	1 U
Chloroform[c]	ND	7 U	16	1 U	ND	1 U
Methylene chloride[c]	ND	7 U	100	5 B	NA	2
Trichloroethene[c]	ND	7 U	2	0.5	ND	1 U
Vinyl chloride[c]	NA	7 U	ND	1 U	NA	1 U

[c] Cancer ND Not detected J Estimated B Found in Blank L Analyte present. Reported value may be biased low.
[n] Noncancer NA Not analyzed U Non-detected UJ Non-detected

TABLE 2-3 SUMMARY OF HUMAN HEALTH RISKS AT IR SITE 1, OLD BASE LANDFILL

Compound	1999 Exposure Point Concentration (mg/L)	1994/1994 HQ Child	1999 HQ Child	1994/1994 HQ Adult	1999 HQ Adult	1991/1994 Lifetime Cancer Risk	1999 Lifetime Cancer Risk
Antimony	NC	4.9E+00	NC	2.1E+00	NC	NA	NC
Arsenic	1.3E-03	2.0E-01	2.8E-01	9.0E-02	1.2E-01	2.7E-05	2.9E-05
Benzene	9.0E-04	NC	2.2E-02	NC	3.3E-02	NC	8.3E-07
Chlorobenzene	6.0E-02	4.0E-01	3.1E-01	4.0E-01	2.5E-01	NA	NA
Chloroform	NC	3.0E-02	NA	1.8E+00	NC	6.3E-06	NC
Cis-1,2-Dichloroethene	6.2E-03	1.0E-01	4.2E-02	4.0E-02	1.8E-02	NA	NA
1,2-Dichloropropane	NC	NA	NC	4.0E-02	NC	1.3E-06	NC
1,4-Dichlorobenzene	NC	3.0E-02	NC	2.0E-02	NC	6.6E-06	NC
Total-1,2-Dichloroethene	3.4E-02		2.6E-01		1.1E-01		NC
Heptachlor	3.5E-05	NC	6.8E-03	NC	2.6E-03	NC	4.7E-06
Iron	2.3E+01	5.3E+00	4.8E+00	2.3E+00	2.1E+00	NA	NA
Manganese	5.5E+00	2.3E+01	1.8E+01	9.8E+00	7.6E+00	NA	NA
Methylene Chloride	NC	7.0E-03	NC	3.0E-03	NC	1.0E-06	NC
Thallium	NC	9.5E-01	NC	4.0E-01	NC	NA	NC
Trichloroethene	3.0E-03	9.0E-02	3.8E-02	4.0E-02	1.5E-02	2.1E-06	8.0E-07
Vinyl Chloride	6.0E-04	NA	NA	NA	NA	2.7E-05	2.1E-05
TOTAL		**3.5E+01**	**2.3E+01**	**1.7E+01**	**1.0E+01**	**7.1E-05**	**5.6E-05**

NA = Not applicable
NC = Not selected as a chemical of potential concern

TABLE 2-4 SUMMARY OF HUMAN HEALTH RISKS AT IR SITE 2, FIRE TRAINING AREA

Compound	1999 Exposure Point Concentration (mg/L)	1994/1994 HQ Child	1999 HQ Child	1994/1994 HQ Adult	1999 HQ Adult	1991/1994 Lifetime Cancer Risk	1999 Lifetime Cancer Risk
Antimony	1.7E-03	NC	2.7E-01	NC	1.2E-01	NC	NA
Arsenic	NC	2.4E-01	NC	1.0E-01	NC	2.5E-05	NC
Iron	3.9E+01	1.7E+01	8.4E+00	7.4E+00	3.6E+00	NA	NA
Manganese	3.9E+00	1.8E+01	1.2E+01	7.7E+00	5.4E+00	NA	NA
Benzo(a)anthracene	NC	NA	NC	NA	NC	1.3E-05	NC
Benzo(a)pyrene	NC	NA	NC	NA	NC	2.5E-04	NC
Benzo(k)fluoranthene	NC	NA	NC	NA	NC	1.8E-06	NC
Chrysene	NC	NA	NC	NA	NC	1.8E-07	NC
Indeno(1,2,3-cd)pyrene	NC	NA	NC	NA	NC	2.5E-05	NC
1,1,2,2-Tetrachloroethane	NC	6.0E-03	NC	3.0E-03	NC	3.2E-05	NC
Thallium	NC	9.0E-01	NC	3.9E-01	NC	NA	NC
Chloroform	NC	4.0E-02	NC	2.5E+00	NC	9.0E-06	NC
TOTAL		**3.7E+01**	**2.1E+01**	**1.8E+01**	**9.0E+00**	**3.5E-04**	**0.0E+00**

NA = Not applicable
NC = Not selected as a chemical of potential concern

TABLE 2-5 POTENTIAL ECOLOGICAL RISK DRIVERS AT THE OLD BASE LANDFILL AND FIRE TRAINING AREA

Old Base Landfill				Fire Training Area	
Benthos	Benthos	Piscivorous Birds Kingfisher	Omnivorous Mammals Raccoon	Piscivorous Birds Kingfisher	Omnivorous Mammals Raccoon
2-methylnapthalene	4,4'-DDD	Benzo(a)anthracene	Acenaphthylene	Aluminum	Aluminum
Acenaphthene	4,4'-DDE	Benzo(a)pyrene	Anthracene	Copper	Chromium (total)
Acenaphthylene	4,4'-DDT	Benzo(b)fluoranthene	Benzo(a)anthracene	Lead	Copper
Anthracene	Methoxychlor	Benzo(g,h,i)perylene	Benzo(a)pyrene		Lead
Fluorene	alpha-Chlordane	Chrysene	Benzo(b)fluoranthene		Manganese
Naphthalene	gamma-Chlordane	Fluoranthene	Benzo(g,h,i)perylene		
Phenanthrene	Aluminum	Phenanthrene	Benzo(k)fluoranthene		
Benzo(a)anthracene	Antimony	Pyrene	Chrysene		
Benzo(a)pyrene	Beryllium	alpha-chlordane	Fluoranthene		
Benzo(b)fluoranthene	Cadmium	gamma-chlordane	Fluorene		
Benzo(g,h,i)perylene	Chromium (total)	Aluminum	Indeno(1,2,3-cd)pyrene		
Chrysene	Copper	Cadmium	Phenanthrene		
Dibenz(a,h)anthracene	Iron	Copper	Pyrene		
Fluoranthene	Lead	Lead	Aluminum		
Indeno(1,2,3-c,d)pyrene	Manganese	Mercury	Chromium, total		
Pyrene	Mercury	Zinc	Copper		
	Nickel		Lead		
	Selenium		Manganese		
	Zinc		Mercury		

Based on USFWS (1998)

TABLE 2-6 COMPARATIVE SCREENING OF RISK TO BENTHOS FROM SEDIMENT AT OLD BASE LANDFILL

FWS Risk Drivers	Risk Screen Based on 1991/1994 Data: Maximum Concentration	Detection Frequency	Benchmark Concentration	HQ	Risk Screen Based on 1999 Data: Maximum Concentration	Detection Frequency	HQ	99HQ/ 91-94HQ	> 20% Change	Direction of Change
2-methylnapthalene	500	0.11	70	7.1	16	0.83	0.2	0.03	Yes	Decrease
Acenaphthene	180	0.21	16	11.3	55	1.00	3.4	0.31	Yes	Decrease
Acenaphthylene	15000	0.11	44	340.9	15	0.83	0.3	0.001	Yes	Decrease
Anthracene	27000	0.46	85.3	316.5	140	1.00	1.6	0.01	Yes	Decrease
Fluorene	13000	0.29	19	684.2	72	1.00	3.8	0.01	Yes	Decrease
Naphthalene	1700	0.14	160	10.6	20	0.83	0.1	0.01	Yes	Decrease
Phenanthrene	120000	0.86	240	500.0	640	1.00	2.7	0.01	Yes	Decrease
Benzo(a)anthracene	47000	0.79	261	180.1	490	1.00	1.9	0.01	Yes	Decrease
Benzo(a)pyrene	54000	0.79	430	125.6	670	1.00	1.6	0.01	Yes	Decrease
Benzo(b)fluoranthene	74000	0.93	3200	23.1	730	1.00	0.2	0.01	Yes	Decrease
Benzo(g,h,i)perylene	36000	0.64	670	53.7	420	1.00	0.6	0.01	Yes	Decrease
Chrysene	55000	0.82	384	143.2	370	1.00	1.0	0.01	Yes	Decrease
Dibenz(a,h)anthracene	9100	0.32	63.4	143.5	68	1.00	1.1	0.01	Yes	Decrease
Fluoranthene	120000	0.96	600	200.0	760	1.00	1.3	0.01	Yes	Decrease
Indeno(1,2,3-c,d)pyrene	38000	0.75	600	63.3	440	1.00	0.7	0.01	Yes	Decrease
Pyrene	89000	0.96	665	133.8	1300	1.00	2.0	0.01	Yes	Decrease
4,4'-DDD	220	0.79	16	13.8	150	0.57	9.4	0.68	Yes	Decrease
4,4'-DDE	200	0.86	2.2	90.9	140	0.57	63.6	0.70	Yes	Decrease
4,4'-DDT	440	0.82	1.58	278.5	54	0.14	34.2	0.12	Yes	Decrease
alpha-Chlordane	280	0.32	0.5	560.0	66	0.29	132.0	0.24	Yes	Decrease
gamma-Chlordane	410	0.25	0.5	820.0	62	0.29	124.0	0.15	Yes	Decrease
Chromium (total)	49.4	1.00	5.0	9.9	49	1.00	9.8	0.99	No	
Lead	387	1.00	46.7	8.3	110	1.00	2.4	0.28	Yes	Decrease
Mercury	0.19	0.14	0.15	1.3	0.13	1.00	0.9	0.68	Yes	Decrease
Nickel	57.1	1.00	20.9	2.7	217	1.00	10.4	3.80	Yes	Increase
Zinc	186	1.00	150	1.2	153	1.00	1.0	0.82	No	

Note: Concentrations are ug/kg for organics and mg/kg for metals. 1991/1994 total samples=28. 1999 total samples= 6.

TABLE 2-7 COMPARATIVE SCREENING OF RISK TO BENTHOS FROM SURFACE WATER AT OLD BASE LANDFILL

FWS Risk Drivers	Risk Screen Based on 1991/1994 Data				Risk Screen Based on 1999 Data					
	Maximum Concentration	Detection Frequency	Benchmark Concentration	HQ	Maximum Concentration	Detection Frequency	HQ	99HQ/ 91-94HQ	> 20% Change	Direction of Change
4,4'-DDD	0.81	0.03	0.6	1.4	0.05	0.00	0.08	0.06	Yes	Decrease
Methoxychlor	0.31	0.03	0.03	10.3	0.3	0.00	10.00	0.97	No	
Aluminum	399000	0.93	25.0	15960.0	10.5	0.00	0.42	0.00003	Yes	Decrease
Antimony	58.7	0.03	30.0	2.0	0.9	0.00	0.03	0.02	Yes	Decrease
Beryllium	40.5	0.31	5.3	7.6	0.11	0.00	0.02	0.003	Yes	Decrease
Cadmium	25.4	0.07	0.5	47.9	0.13	0.00	0.25	0.01	Yes	Decrease
Chromium, total	532	0.34	120.0	4.4	1.1	0.80	0.01	0.002	Yes	Decrease
Copper	950	0.41	6.5	146.2	5	1.00	0.77	0.01	Yes	Decrease
Iron	833000	1.00	320.0	2603.1	8370	0.40	26.16	0.01	Yes	Decrease
Lead	1360	0.79	3.2	425.0	3.9	1.00	1.22	0.003	Yes	Decrease
Manganese	15600	1.00	14500	1.1	2460	1.00	0.17	0.16	Yes	Decrease
Mercury	0.81	0.17	0.012	67.5	0.02	0.20	1.67	0.02	Yes	Decrease
Nickel	614	0.34	160	3.8	29.9	0.60	0.19	0.05	Yes	Decrease
Selenium	22.4	0.07	5	4.5	5.9	0.40	1.18	0.26	Yes	Decrease
Zinc	2980	0.86	110	27.1	67.2	1.00	0.61	0.02	Yes	Decrease

Note: Concentrations are ug/L. Metal concentrations are dissolved fraction. 991/1994 total samples=29. 1999 total samples= 5.

TABLE 2-8 COMPARATIVE SCREENING OF FOOD-WEB RISK TO KINGFISHER AT OLD BASE LANDFILL

Food-Web Results Using 1991/1994 Concentration Data														
FWS Risk Drivers	**Maximum Conc. (mg/kg)**	**BAF**	**Conc. in Fish (mg/kg)**	**Conc. from Sediment (mg/kg)**	**Ingestion Rate (kg/day)**	**Water Conc. (mg/kg)**	**Water Ingestion (kg/day)**	**AUF**	**Body Weight (1/kg)**	**Dose (mg/kg/day)**	**LOAEL (mg/kg/day)**	**LOAEL HQ**	**NOAEL (mg/kg/day)**	**NOAEL HQ**
Benzo(a)anthracene	24	1	23.5	0.04	0.06	0.000	0.012	1	8.85	12.5	100	0.1	10	1.2
Benzo(a)pyrene	27	1	27.0	0.05	0.06	0.000	0.012	1	8.85	14.3	100	0.1	10	1.4
Benzo(b)fluoranthene	37	1	36.9	0.1	0.06	0.000	0.012	1	8.85	19.6	100	0.2	10	2.0
Benzo(g,h,i)perylene	18	1	18.0	0.03	0.06	0.000	0.012	1	8.85	9.6	100	0.1	10	1.0
Chrysene	27.5	1	27.5	0.05	0.06	0.003	0.012	1	8.85	14.6	100	0.1	10	1.5
Fluoranthene	60	1	59.9	0.1	0.06	0.008	0.012	1	8.85	31.9	100	0.3	10	3.2
Phenanthrene	60	1	59.9	0.1	0.06	0.010	0.012	1	8.85	31.9	100	0.3	10	3.2
Pyrene	44.5	1	44.4	0.1	0.06	0.005	0.012	1	8.85	23.6	100	0.2	10	2.4
alpha-chlordane	0.14	1	0.1	0.0002	0.06	0.000	0.012	1	8.85	0.1	0.19	0.4	0.019	3.9
gamma-chlordane	0.205	1	0.2	0.0003	0.06	0.000	0.025	1	8.85	0.1	0.19	0.6	0.019	5.7
Aluminum	4840	1	4831.8	8.2	0.06	399	0.012	1	8.85	2612	165	16	84	31
Cadmium	1.6	1	1.5	0.003	0.06	0.025	0.012	1	8.85	0.8	3.31	0.2	0.33	2.5
Copper	26.2	1	26.1	0.04	0.06	0.749	0.012	1	8.85	14.0	2.35	5.9	0.235	59
Lead	193.5	1	193	0.3	0.06	1.8	0.012	1	8.85	103	3.0	34	0.3	343
Mercury	0.095	1	0.1	0.0002	0.06	0.0008	0.012	1	8.85	0.05	0.12	0.42	0.012	4.2
Zinc	93	1	92.8	0.2	0.06	2.98	0.012	1	8.85	50	139	0.4	13.9	3.6

TABLE 2-8 (Continued)

Food-Web Results Using 1999 Concentration Data															
FWS Risk Drivers	**Maximum Conc. (mg/kg)**	**BAF**	**Conc. in Fish (mg/kg)**	**Conc. From Sediment (mg/kg)**	**Ingestion Rate (kg/day)**	**Water Conc. (mg/kg)**	**Water Ingestion (kg/day)**	**AUF**	**Body Weight (1/kg)**	**Dose (mg/kg/day)**	**LOAEL (mg/kg/day)**	**LOAEL HQ**	**NOAEL (mg/kg/day)**	**NOAEL HQ**
Benzo(a)anthracene	0.49	1	0.5	0.0008	0.06	0.00015	0.012	1	8.85	0.3	100	0.0	10	0.0
Benzo(a)pyrene	0.67	1	0.7	0.0011	0.06	0.00015	0.012	1	8.85	0.4	100	0.0	10	0.0
Benzo(b)fluoranthene	0.73	1	0.7	0.0012	0.06	0.00015	0.012	1	8.85	0.4	100	0.0	10	0.0
Benzo(g,h,i)perylene	0.42	1	0.4	0.0007	0.06	0.00015	0.012	1	8.85	0.2	100	0.0	10	0.0
Chrysene	0.37	1	0.4	0.0006	0.06	0.00015	0.012	1	8.85	0.2	100	0.0	10	0.0
Fluoranthene	0.76	1	0.8	0.0013	0.06	0.00015	0.012	1	8.85	0.4	100	0.0	10	0.0
Phenanthrene	0.64	1	0.6	0.0011	0.06	0.00015	0.012	1	8.85	0.3	100	0.0	10	0.0
Pyrene	1.3	1	1.3	0.0022	0.06	0.00015	0.012	1	8.85	0.7	100	0.0	10	0.1
alpha-chlordane	0.066	1	0.1	0.0001	0.06	0.00003	0.012	1	8.85	0.0	0.19	0.2	0.019	1.8
gamma-chlordane	0.062	1	0.1	0.0001	0.06	0.00003	0.025	1	8.85	0.0	0.19	0.2	0.019	1.7
Aluminum	15400	1	15373.8	26.2	0.06	0.28400	0.012	1	8.85	8177	165	50	84	97
Cadmium	0.4	1	0.4	0.0007	0.06	0.00013	0.012	1	8.85	0.2	3.31	0.1	0.33	0.7
Copper	52.2	1	52.1	0.089	0.06	0.00450	0.012	1	8.85	27.7	2.35	11.8	0.235	118
Lead	110	1	110	0.19	0.06	0.00200	0.012	1	8.85	58	3.0	19	0.3	195
Mercury	0.13	1	0.1	0.0002	0.06	0.00003	0.012	1	8.85	0.07	0.12	0.58	0.012	5.8
Zinc	153	1	152.7	0.26	0.06	0.09690	0.012	1	8.85	81	139	0.6	13.9	5.8

TABLE 2-8 (Continued)

FWS Risk Drivers	COMPARISON OF 1991/1994 AND 1999 FOOD-WEB SCREENING RESULTS									
	LOAEL DATA COMPARISON					NOAEL DATA COMPARISON				
	1991/1994 LOAEL HQ	1999 LOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change	1991/1994 NOAEL HQ	1999 NOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change
Benzo(a)anthracene	0.1	0.003	0.02	Yes	Decrease	1.2	0.026	0.02	Yes	Decrease
Benzo(a)pyrene	0.1	0.004	0.02	Yes	Decrease	1.4	0.036	0.02	Yes	Decrease
Benzo(b)fluoranthene	0.2	0.004	0.02	Yes	Decrease	2.0	0.039	0.02	Yes	Decrease
Benzo(g,h,i)perylene	0.1	0.002	0.02	Yes	Decrease	1.0	0.022	0.02	Yes	Decrease
Chrysene	0.1	0.002	0.01	Yes	Decrease	1.5	0.020	0.01	Yes	Decrease
Fluoranthene	0.3	0.004	0.01	Yes	Decrease	3.2	0.040	0.01	Yes	Decrease
Phenanthrene	0.3	0.003	0.01	Yes	Decrease	3.2	0.034	0.01	Yes	Decrease
Pyrene	0.2	0.007	0.03	Yes	Decrease	2.4	0.069	0.03	Yes	Decrease
alpha-chlordane	0.4	0.184	0.47	Yes	Decrease	3.9	1.8	0.47	Yes	Decrease
gamma-chlordane	0.6	0.173	0.30	Yes	Decrease	5.7	1.7	0.30	Yes	Decrease
Aluminum	15.8	50	3.13	Yes	Increase	31.1	97.4	3.13	Yes	Increase
Cadmium	0.2	0.07	0.28	Yes	Decrease	2.5	0.71	0.28	Yes	Decrease
Copper	5.9	11.8	1.98	Yes	Increase	59.4	118.0	1.98	Yes	Increase
Lead	34.3	19	0.57	Yes	Decrease	343.1	194.7	0.57	Yes	Decrease
Mercury	0.4	0.58	1.37	Yes	Increase	4.2	5.8	1.37	Yes	Increase
Zinc	0.4	0.6	1.63	Yes	Increase	3.6	5.8	1.63	Yes	Increase

Note: 1991/1994 concentration data and food-web model procedures from USFWS (1998). Water concentrations of metals are total fraction.

TABLE 2-9 COMPARATIVE SCREENING OF FOOD-WEB RISK TO RACCOON AT OLD BASE LANDFILL

Food-Web Results Using 1991/1994 Concentration Data														
FWS Risk Drivers	Maximum Conc. (mg/kg)	BAF	Conc. in Fish (mg/kg)	Conc. from Sediment (mg/kg)	Ingestion Rate (kg/day)	Water Conc. (mg/kg)	Water Ingestion (kg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	LOAEL HQ	NOAEL (mg/kg/day)	NOAEL HQ
Acenaphthylene	7.5	1	7	0.7	0.5	0.000	0.025	1	0.5	1.9	2.6	0.7	1.3	1.4
Anthracene	13.5	1	12	1.3	0.5	0.000	0.025	1	0.5	3.4	2.6	1.3	1.3	2.6
Benzo(a)anthracene	23.5	1	21	2.2	0.5	0.000	0.025	1	0.5	5.9	2.6	2.3	1.3	4.5
Benzo(a)pyrene	27	1	24	2.5	0.5	0.000	0.025	1	0.5	6.8	2.6	2.6	1.3	5.2
Benzo(b)fluoranthene	37	1	34	3.5	0.5	0.000	0.025	1	0.5	9.3	2.6	3.6	1.3	7.1
Benzo(g,h,i)perylene	18	1	16	1.7	0.5	0.000	0.025	1	0.5	4.5	2.6	1.7	1.3	3.5
Benzo(k)fluoranthene	17.5	1	16	1.6	0.5	0.000	0.025	1	0.5	4.4	2.6	1.7	1.3	3.4
Chrysene	27.5	1	25	2.6	0.5	0.003	0.025	1	0.5	6.9	2.6	2.6	1.3	5.3
Fluoranthene	60	1	54	5.6	0.5	0.008	0.025	1	0.5	15.0	2.6	5.8	1.3	12
Fluorene	6.5	1	6	0.6	0.5	0.003	0.025	1	0.5	1.6	2.6	0.6	1.3	1.3
Indeno(1,2,3-cd)pyrene	19	1	17	1.8	0.5	0.000	0.025	1	0.5	4.8	2.6	1.8	1.3	3.7
Phenanthrene	60	1	54	5.6	0.5	0.010	0.025	1	0.5	15.0	2.6	5.8	1.3	12
Pyrene	44.5	1	40	4.2	0.5	0.005	0.025	1	0.5	11.1	2.6	4.3	1.3	8.6
Aluminum	4840	1	4385	455	0.5	399	0.025	1	0.5	1215.0	55	22	5.5	221
Chromium, total	24.7	1	22	2.3	0.5	0.532	0.025	1	0.5	6.2	1.7	3.6	0.17	36
Copper	26.2	1	24	2.5	0.5	0.749	0.025	1	0.5	6.5	10	0.7	1	6.5
Lead	193.5	1	175	18	0.5	1.8	0.025	1	0.5	48	1.5	32	0.15	323
Manganese	2800	1	2537	263	0.5	15.6	0.025	1	0.5	700	13	54	1.3	539
Mercury	0.095	1	0.09	0.009	0.5	0.0008	0.025	1	0.5	0.02	0.1	0.2	0.01	2.4

TABLE 2-9 (Continued)

Food-Web Results Using 1999 Concentration Data														
FWS Risk Drivers	Maximum Conc. (mg/kg)	BAF	Conc. in Fish (mg/kg)	Conc. from Sediment (mg/kg)	Ingestion Rate (kg/day)	Water Conc. (mg/kg)	Water Ingestion (kg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	LOAEL HQ	NOAEL (mg/kg/day)	NOAEL HQ
Acenaphthylene	0.015	1	0.014	0.001	0.5	0.00015	0.025	1	0.5	0.004	2.6	0.001	1.3	0.003
Anthracene	0.14	1	0.127	0.013	0.5	0.00015	0.025	1	0.5	0.035	2.6	0.01	1.3	0.03
Benzo(a)anthracene	0.49	1	0.444	0.046	0.5	0.00015	0.025	1	0.5	0.123	2.6	0.05	1.3	0.09
Benzo(a)pyrene	0.67	1	0.607	0.063	0.5	0.00015	0.025	1	0.5	0.168	2.6	0.06	1.3	0.13
Benzo(b)fluoranthene	0.73	1	0.661	0.069	0.5	0.00015	0.025	1	0.5	0.183	2.6	0.07	1.3	0.14
Benzo(g,h,i)perylene	0.42	1	0.381	0.039	0.5	0.00015	0.025	1	0.5	0.105	2.6	0.04	1.3	0.08
Benzo(k)fluoranthene	0.16	1	0.145	0.015	0.5	0.00015	0.025	1	0.5	0.040	2.6	0.02	1.3	0.03
Chrysene	0.37	1	0.335	0.035	0.5	0.00015	0.025	1	0.5	0.093	2.6	0.04	1.3	0.07
Fluoranthene	0.76	1	0.689	0.071	0.5	0.00015	0.025	1	0.5	0.190	2.6	0.07	1.3	0.15
Fluorene	0.072	1	0.065	0.007	0.5	0.00015	0.025	1	0.5	0.018	2.6	0.01	1.3	0.01
Indeno(1,2,3-cd)pyrene	0.44	1	0.399	0.041	0.5	0.00015	0.025	1	0.5	0.110	2.6	0.04	1.3	0.08
Phenanthrene	0.64	1	0.580	0.060	0.5	0.00015	0.025	1	0.5	0.160	2.6	0.06	1.3	0.12
Pyrene	1.3	1	1.178	0.122	0.5	0.00015	0.025	1	0.5	0.325	2.6	0.13	1.3	0.25
Aluminum	15400	1	13952	1448	0.5	399.00	0.025	1	0.5	3855.0	55	70	5.5	701
Chromium, total	49	1	44	4.6	0.5	0.0014	0.025	1	0.5	12.3	1.7	7.2	0.17	72
Copper	52.2	1	47	4.9	0.5	0.7490	0.025	1	0.5	13.1	10	1.3	1	13.1
Lead	110	1	100	10	0.5	1.7600	0.025	1	0.5	28	1.5	18	0.15	183
Manganese	608	1	551	57	0.5	2.3500	0.025	1	0.5	152	13	12	1.3	117
Mercury	0.13	1	0.118	0.012	0.5	0.0008	0.025	1	0.5	0.033	0.1	0.33	0.01	3.3

TABLE 2-9 (Continued)

FWS Risk Drivers	COMPARISON OF 1991/1994 AND 1999 FOOD-WEB SCREENING RESULTS									
	LOAEL DATA COMPARISON					NOAEL DATA COMPARISON				
	1991/1994 LOAEL HQ	1999 LOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change	1991/1994 NOAEL HQ	1999 NOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change
Acenaphthylene	0.7	0.001	0.00	Yes	Decrease	1.4	0.003	0.002	Yes	Decrease
Anthracene	1.3	0.01	0.01	Yes	Decrease	2.6	0.03	0.01	Yes	Decrease
Benzo(a)anthracene	2.3	0.05	0.02	Yes	Decrease	4.5	0.09	0.02	Yes	Decrease
Benzo(a)pyrene	2.6	0.1	0.02	Yes	Decrease	5.2	0.1	0.02	Yes	Decrease
Benzo(b)fluoranthene	3.6	0.1	0.02	Yes	Decrease	7.1	0.1	0.02	Yes	Decrease
Benzo(g,h,i)perylene	1.7	0.04	0.02	Yes	Decrease	3.5	0.08	0.02	Yes	Decrease
Benzo(k)fluoranthene	1.7	0.02	0.01	Yes	Decrease	3.4	0.03	0.01	Yes	Decrease
Chrysene	2.6	0.04	0.01	Yes	Decrease	5.3	0.07	0.01	Yes	Decrease
Fluoranthene	5.8	0.1	0.01	Yes	Decrease	11.5	0.1	0.01	Yes	Decrease
Fluorene	0.6	0.007	0.01	Yes	Decrease	1.3	0.01	0.01	Yes	Decrease
Indeno(1,2,3-cd)pyrene	1.8	0.04	0.02	Yes	Decrease	3.7	0.08	0.02	Yes	Decrease
Phenanthrene	5.8	0.1	0.01	Yes	Decrease	11.5	0.1	0.01	Yes	Decrease
Pyrene	4.3	0.1	0.03	Yes	Decrease	8.6	0.3	0.03	Yes	Decrease
Aluminum	22.1	70.1	3.17	Yes	Increase	220.9	701	3.17	Yes	Increase
Chromium, total	3.6	7.2	1.98	Yes	Increase	36.4	72	1.98	Yes	Increase
Copper	0.7	1.3	1.99	Yes	Increase	6.5	13	1.99	Yes	Increase
Lead	32.3	18.3	0.57	Yes	Decrease	323	183	0.57	Yes	Decrease
Manganese	53.9	11.7	0.22	Yes	Decrease	539	117	0.22	Yes	Decrease
Mercury	0.2	0.3	1.37	Yes	Increase	2.4	3	1.37	Yes	Increase

Note: 1991/1994 concentration data and food-web model procedures from USFWS (1998). Water concentrations of metals are total fraction.

TABLE 2-10 COMPARATIVE SCREENING OF FOOD-WEB RISK TO KINGFISHER AND RACCOON AT FIRE TRAINING AREA

FWS Risk Drivers	Maximum Conc. (mg/kg)	BAF	Conc. in Fish (mg/kg)	Conc. from Sediment (mg/kg)	Ingestion Rate (kg/day)	Water Conc. (mg/kg)	Water Ingestion (kg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	LOAEL HQ	NOAEL (mg/kg/day)	NOAEL HQ
Food-Web Results Using 1991/1994 Concentration Data: Kingfisher														
Aluminum	1855	1	1851.8	3.15	0.06	33.2	0.012	1	8.85	989	165	6.0	84	12
Copper	4.4	1	4.4	0.01	0.06	0.435	0.012	1	8.85	2.4	2.35	1.0	0.235	10
Lead	17.8	1	17.7	0.03	0.06	0.498	0.012	1	8.85	9.5	3	3.2	0.3	32
Food-Web Results Using 1991/1994 Concentration Data: Raccoon														
Aluminum	1855	1	1680.63	174.4	0.5	33.2	0.025	1	0.5	464	55	8.4	5.5	84
Chromium (total)	4.55	1	4.12	0.4	0.5	0.081	0.025	1	0.5	1.1	1.7	0.7	0.17	6.7
Copper	4.4	1	3.99	0.4	0.5	0.435	0.025	1	0.5	1.1	10	0.1	1	1.1
Lead	17.8	1	16.13	1.7	0.5	0.498	0.025	1	0.5	4.5	1.5	3.0	0.15	30
Manganese	359.5	1	325.71	33.8	0.5	7.080	0.025	1	0.5	90	13	6.9	1.3	69

FWS Risk Drivers	Maximum Conc. (mg/kg)	BAF	Conc. in Fish (mg/kg)	Conc. from Sediment (mg/kg)	Ingestion Rate (kg/day)	Water Conc. (mg/kg)	Water Ingestion (kg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	LOAEL HQ	NOAEL (mg/kg/day)	NOAEL HQ
Food-Web Results Using 1999 Concentration Data: Kingfisher														
Aluminum	2230	1	2226.2	3.79	0.06	0.3	0.012	1	8.85	1184	165	7.2	84	14.1
Copper	2.1	1	2.1	0.004	0.06	0.004	0.012	1	8.85	1.1	2.35	0.5	0.235	4.7
Lead	5.0	1	5.0	0.009	0.06	0.002	0.012	1	8.85	2.7	3	0.9	0.3	8.9
Food-Web Results Using 1999 Concentration Data: Raccoon														
Aluminum	2230	1	2020.38	209.6	0.5	0.3	0.025	1	0.5	558	55	10.1	5.5	101.4
Chromium (total)	4.2	1	3.81	0.39	0.5	0.001	0.025	1	0.5	1.1	1.7	0.6	0.17	6.2
Copper	2.1	1	1.90	0.20	0.5	0.004	0.025	1	0.5	0.5	10	0.1	1	0.5
Lead	5	1	4.53	0.47	0.5	0.002	0.025	1	0.5	1.3	1.5	0.8	0.15	8.3
Manganese	176	1	159.46	16.5	0.5	0.155	0.025	1	0.5	44	13	3.4	1.3	33.8

TABLE 2-10 (Continued)

FWS Risk Drivers	COMPARISON OF 1991/1994 AND 1999 FOOD-WEB SCREENING RESULTS									
	LOAEL DATA COMPARISON					NOAEL DATA COMPARISON				
	1991/1994 LOAEL HQ	1999 LOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change	1991/1994 NOAEL HQ	1999 NOAEL HQ	1999HQ/ 91-94HQ	>20% Change	Direction of Change
Kingfisher										
Aluminum	6.0	7.2	1.20	No		12.0	14.1	1.17	No	
Copper	1.0	0.5	0.47	Yes	Decrease	10.0	4.7	0.47	Yes	Decrease
Lead	3.2	0.9	0.28	Yes	Decrease	32.0	8.9	0.28	Yes	Decrease
Raccoon										
Aluminum	8.4	10.1	1.20	No		84.0	101.4	1.21	Yes	Increase
Chromium (total)	0.7	0.6	0.92	No		6.7	6.2	0.92	No	
Copper	0.1	0.1	0.47	Yes	Decrease	1.1	0.5	0.48	Yes	Decrease
Lead	3.0	0.8	0.28	Yes	Decrease	30.0	8.3	0.28	Yes	Decrease
Manganese	6.9	3.4	0.49	Yes	Decrease	69.0	33.8	0.49	Yes	Decrease

Note: 1991/1994 concentration data and food-web model procedures from USFWS (1998). Water concentrations are total fraction.

TABLE 2-11 REMEDIAL ACTION COST ANALYSIS: ALTERNATIVE 2 – INSTITUTIONAL CONTROLS

CAPITAL COSTS	**IR SITE 1**				**IR SITE 2**			
Item Description	**Quantity**	**Unit**	**Cost/ Unit**	**Cost**	**Quantity**	**Unit**	**Cost/ Unit**	**Cost**
Deed Restrictions	1	Each	$2,500	$2,500	1	Each	$2,500	$2,500
Total Direct Capital Costs				*$2,500*				*$2,500*
Contingency Allowance	5%			$125	5%			$125
TOTAL CAPITAL COSTS (Rounded to the nearest $1,000)				**$3,000**				**$3,000**

YEARLY OPERATION AND MAINTENANCE (O&M) COSTS	**IR SITE 1**				**IR SITE 2**			
Item Description	**Quantity/ Year**	**Unit**	**Cost/ Unit**	**Cost**	**Quantity/ Year**	**Unit**	**Cost/ Unit**	**Cost**
Mobilization/Demobilization & Reports	2	Event	$3,750	$7,500	NA	NA	NA	NA
Sediment and Surface-Water Sampling & Analyses	11	Sample	$410	$4,510	NA	NA	NA	NA
Ground-Water Sampling & Analyses	20	Sample	$366	$7,320	NA	NA	NA	NA
Subtotal O&M Costs				*$19,330*	NA	NA	NA	NA
Overhead and Profit	15%			$2,900	NA	NA	NA	NA
Administration	5%			$967	NA	NA	NA	NA
Subtotal O&M Costs				*$23,197*	NA	NA	NA	NA
Contingency Allowance	15%			$3,480	NA	NA	NA	NA
TOTAL O&M COSTS (Rounded to the nearest $1,000)				**$27,000**				**NA**

2-YEAR COST PROJECTION, ASSUMED ANNUAL DISCOUNT RATE:	6%				NA			
Present Worth of 2 Years of O&M (Rounded to nearest $1,000)				$52,000				NA
Total Capital Costs				$3,000				NA
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to nearest $1,000)				**$55,000**				**$3,000**

TABLE 2-12 REMEDIAL ACTION COST ANALYSIS: ALTERNATIVE 3 – GROUND-WATER TREATMENT

CAPITAL COSTS	**IR SITE 1**				**IR SITE 2**			
Item Description	**Quantity**	**Unit**	**Cost/Unit**	**Cost**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Mobilization/Demobilization	1	Lump sum	$17,100	$17,100	1	Lump sum	$10,200	$10,200
Extraction Pumping System (25 gmp)	1	Lump sum	$16,000	$16,000	1	Lump sum	$2,700	$2,700
Treatment Building & Control System	1	Unit	$51,000	$51,000	1	Unit	$38,000	$38,000
Air Stripping Unit	1	Unit	$12,000	$12,000	NA	NA	NA	NA
Pre-Treatment Unit (Precipitation/Coagulation/Flocculation)	1	Unit	$42,000	$42,000	1	Unit	$33,000	$33,000
Sedimentation Unit (Clarifier)	1	Unit	$20,000	$20,000	1	Unit	$11,000	$11,000
Liquid-Phase Carbon Unit	NA	NA	NA	NA	1	Unit	$3,800	$3,800
Start Up	1	Lump sum	$7,100	$7,100	1	Lump sum	$4,200	$4,200
7-foot Galvanized Chain-Link Fence	NA	NA	NA	NA	250	Linear Ft	$27	$6,750
Swing Gat, 12-foot, Double Wide	NA	NA	NA	NA	2	Each	$497	$994
Installation of Warning Signs	NA	NA	NA	NA	6	Each	$49	$294
Clear and Grub Sediment Areas	1.1	Acres	$161	$177	0.07	Acres	$161	$12
Excavate and Dispose Sediments	310	Cu yds	$62	$19,220	10	Cu yds	$78	$780
Restoration	1.3	Acres	$3,000	$3,900	0.08	Acres	$3,000	$240
Total Direct Capital Costs (Rounded to nearest $1,000)				*$188,000*				*$112,000*
Indirect Capital Costs								
Survey & Stakeout	1	Lump sum	$2,500	$2,500	1	Lump sum	$1,700	$1,700
Engineering and Design	1	Lump sum	$40,000	$40,000	1	Lump sum	$40,000	$40,000
Legal Fees and License/Permit Costs	5%			$9,400	5%			$5,600
Contractor Reporting Requirements	5%			$9,400	5%			$5,600
Construction Oversight	15%			$28,200	15%			$16,800
Total Indirect Capital Costs (Rounded to nearest $1,000)				*$90,000*				*$70,000*
Subtotal Capital Costs				**$278,000**				**$182,000**
Contingency Allowance	5%			$41,700	5%			$27,300
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to the nearest $1,000)				**$320,000**				**$209,000**

TABLE 2-12 REMEDIAL ACTION COST ANALYSIS: ALTERNATIVE 3 – GROUND-WATER TREATMENT (Cont'd)

YEARLY OPERATION AND MAINTENANCE (O&M) COSTS	**IR SITE 1**				**IR SITE 2**			
Item Description	**Quantity/ Year**	**Unit**	**Cost/Unit**	**Cost**	**Quantity/ Year**	**Unit**	**Cost/Unit**	**Cost**
Mobilization/Demobilization & Reports	2	Event	$3,750	$7,500	2	Event	$3,750	$7,500
Sediment and Surface-Water Sampling & Analyses	5	Sample	$410	$2,050	4	Sample	$410	$1,640
Ground-Water Sampling & Analyses	20	Sample	$366	$7,320	10	Sample	$366	$3,659
Fence Repair/Gate Maintenance	NA	NA	NA	NA	5%	Year	$400	$400
Treatment Plant Operation	1	Year	$41,600	$41,600	1	Year	$33,000	$33,000
Subtotal O&M Costs				*$58,470*				*$46,199*
Overhead and Profit	15%			$8,770	15%			$6,930
Administration	5%			$2,923	5%			$2,310
Insurance, Taxes, Licenses	2.5%			$1,462	2.5%			$1,155
Subtotal O&M Costs				*$71,625*				*$56,594*
Contingency Allowance	15%			$10,743	15%			$8,489
TOTAL O&M COSTS (Rounded to the nearest $1,000)				**$82,000**				**$65,000**

5-YEAR COST PROJECTION, ASSUMED ANNUAL DISCOUNT RATE:	6%				6%			
Present Worth of 5 Years of O&M (Rounded to nearest $1,000)				$366,000				$290,000
Total Capital Costs				$320,000				$209,000
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to nearest $1,000)				**$686,000**				**$499,000**

TABLE 2-13 REMEDIAL ACTION COST ANALYSIS: IR SITE 1 – OLD BASE LANDFILL: ALTERNATIVE 3 –GROUND-WATER TREATMENT

CAPITAL COSTS				
Item Description	**Quantity**	**Unit**	**Cost/ Unit**	**Cost**
Mobilization/Demobilization	1	Lump sum	$17,100	$17,100
Extraction Pumping System (25 gmp)	1	Lump sum	$16,000	$16,000
Treatment Building & Control System	1	Unit	$51,000	$51,000
Air Stripping Unit	1	Unit	$12,000	$12,000
Pre-Treatment Unit (Precipitation/Coagulation/Flocculation)	1	Unit	$42,000	$42,000
Sedimentation Unit (Clarifier)	1	Unit	$20,000	$20,000
Start Up	1	Lump sum	$7,100	$7,100
Clear and Grub Sediment Areas	1.1	Acres	$161	$177
Excavate and Dispose Sediments	310	Cu yds	$62	$19,220
Restoration	1.3	Acres	$3,000	$3,900
Total Direct Capital Costs (Rounded to nearest $1,000)				*$188,000*
Indirect Capital Costs				
Survey & Stakeout	1	Lump sum	$2,500	$2,500
Engineering and Design	1	Lump sum	$40,000	$40,000
Legal Fees and License/Permit Costs	5%			$9,400
Contractor Reporting Requirements	5%			$9,400
Construction Oversight	15%			$28,200
Total Indirect Capital Costs (Rounded to nearest $1,000)				*$90,000*
Subtotal Capital Costs				**$278,000**
Contingency Allowance	5%			$41,700
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to the nearest $1,000)				**$320,000**

YEARLY OPERATION AND MAINTENANCE (O&M) COSTS				
Item Description	**Quantity/ Year**	**Unit**	**Cost/ Unit**	**Cost**
Mobilization/Demobilization & Reports	2	Event	$3,750	$7,500
Sediment and Surface-Water Sampling & Analyses	5	Sample	$410	$2,050
Ground-Water Sampling & Analyses	20	Sample	$366	$7,320
Treatment Plant Operation	1	Year	$41,600	$41,600
Subtotal O&M Costs				*$58,470*
Overhead and Profit	15%			$8,770
Administration	5%			$2,923
Insurance, Taxes, Licenses	2.5%			$1,462
Subtotal O&M Costs				*$71,625*
Contingency Allowance	15%			$10,743
TOTAL O&M COSTS (Rounded to the nearest $1,000)				**$82,000**

5-YEAR COST PROJECTION, ASSUMED ANNUAL DISCOUNT RATE:	6%			
Present Worth of 5 Years of O&M (Rounded to nearest $1,000)				$366,000
Total Capital Costs				$320,000
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to nearest $1,000)				**$686,000**

TABLE 2-14 REMEDIAL ACTION COST ANALYSIS: IR SITE 2 – FIRE TRAINING AREA: ALTERNATIVE 3 –GROUND-WATER TREATMENT

CAPITAL COSTS				
Item Description	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Mobilization/Demobilization	1	Lump sum	$10,200	$10,200
Extraction Pumping System (8 gmp)	1	Lump sum	$2,700	$2,700
Treatment Building & Control System	1	Unit	$38,000	$38,000
Pre-Treatment Unit (Precipitation/Coagulation/Flocculation)	1	Unit	$33,000	$33,000
Sedimentation Unit (Clarifier)	1	Unit	$11,000	$11,000
Liquid-phase Carbon Unit	1	Unit	$3,800	$3,800
Start Up	1	Lump sum	$4,200	$4,200
7-foot galvanized chain-link fence	250	Linear Foot	$27	$6,750
Swing gat, 12-foot, double wide	2	Each	$497	$994
Installation of Warning Signs	6	Each	$49	$294
Clear and Grub Sediment Areas	0.07	Acres	$161	$12
Excavate and Dispose Sediments (premium for small quantity)	10	Cu yds	$78	$780
Restoration	0.08	Acres	$3,000	$240
Total Direct Capital Costs (Rounded to nearest $1,000)				*$112,000*
Indirect Capital Costs				
Survey & Stakeout	1	Lump sum	$1,700	$1,700
Engineering and Design	1	Lump sum	$40,000	$40,000
Legal Fees and License/Permit Costs	5%			$5,600
Contractor Reporting Requirements	5%			$5,600
Construction Oversight	15%			$16,800
Total Indirect Capital Costs (Rounded to nearest $1,000)				*$70,000*
Subtotal Capital Costs				**$182,000**
Contingency Allowance	5%			$27,300
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to the nearest $1,000)				**$209,000**

YEARLY OPERATION AND MAINTENANCE (O&M) COSTS				
Item Description	**Quantity/Year**	**Unit**	**Cost/Unit**	**Cost**
Mobilization/Demobilization & Reports	2	Event	$3,750	$7,500
Sediment Sampling & Analyses	4	Sample	$410	$1,640
Ground-Water Sampling & Analyses	10	Sample	$366	$3,659
Fence Repair/Gate Maintenance	5%	Year	$400	$400
Treatment Plant Operation	1	Year	$33,000	$33,000
Subtotal O&M Costs				*$46,199*
Overhead and Profit	15%			$6,930
Administration	5%			$2,310
Insurance, Taxes, Licenses	2.5%			$1,155
Subtotal O&M Costs				*$56,594*
Contingency Allowance	15%			$8,489
TOTAL O&M COSTS (Rounded to the nearest $1,000)				**$65,000**

5-YR COST PROJECTION, Assumed Annual Discount Rate:	6%			
Present Worth of 5 Years of O&M (Rounded to nearest $1,000)				$290,000
Total Capital Costs				$209,000
TOTAL ALTERNATIVE COST (Total capital plus present worth cost, rounded to nearest $1,000)				**$499,000**